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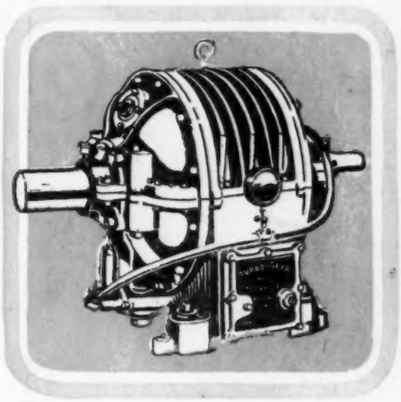

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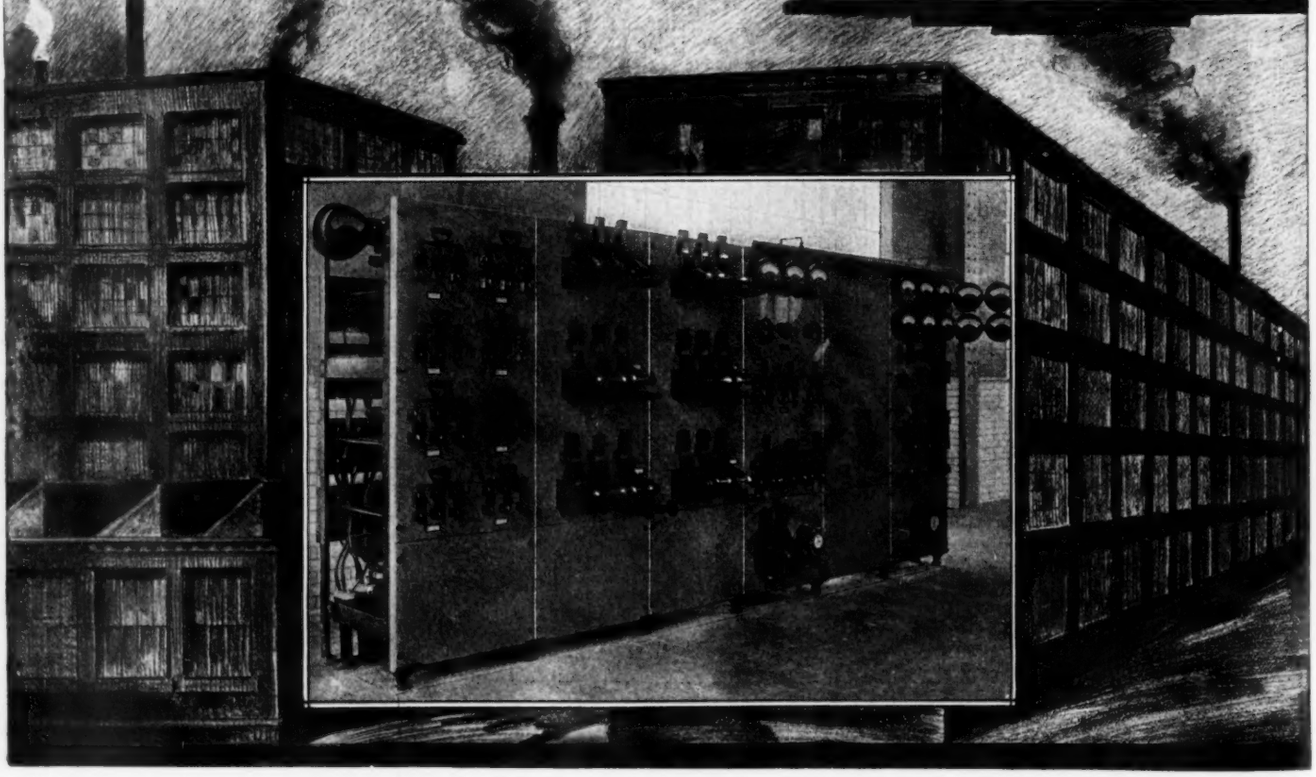


Electrical World

The consolidation of ELECTRICAL WORLD, ELECTRICAL ENGINEER *and* AMERICAN ELECTRICIAN

Volume 75 New York, Saturday, February 14, 1920 *Number* 7

When the Public Owns Stock

WHEN public utilities were operated for maximum profits and minimum service and the "public-be-damned" kind of public policy was in force, unpleasant complaints, unfavorable verdicts in damage suits and wrangles with city officials were the order of things. Nowadays, when the public owns stock and "service" is the governing policy in operation, it is different. The harangues of the politician are scoffed at, the regulating commissions listen to arguments in favor of a fair rate of return to the common people to whom they are responsible, and the stock-holding juryman weighs evidence carefully when it touches his own pocketbook and there are prospects of reducing his ability to pay his lighting bills with his dividends. When the public owns stock the public utility has a friend at court.

Delayed Deliveries

THE delays in deliveries and the acceptance of orders by manufacturers for deliveries far in the future are causing a great deal of explaining these days and placing the facilities of the manufacturer in an unfavorable light. While it is true that the volume of business now piling up in certain lines, particularly in contracting supplies and motors, is calling for a material expansion in manufacturing facilities, the problem of obtaining raw materials is a very serious cause of the slowness of deliveries. In many cases electrical manufacturing plants are able to turn out all the apparatus that available material will permit, and until the stocks of raw material depleted by the war are replenished and the outputs of mills producing sheet steel and tubes, drawn copper and the like are greatly increased, the long deliveries on orders can be little relieved. These are conditions which call for careful estimates of future demands and a great deal of patience.

N. E. L. A. Organized for Service

PRESIDENT BALLARD before starting on his homeward journey to the Pacific Coast last Saturday announced that his recommendation to the executive committee of the National Electric Light Association to departmentalize the activities at headquarters had been favorably received. The new plan is to reorganize the work of the main office at New York City into departments similar to those of an operating company. Two new departments are therefore proposed, one to consider engineering problems and another to handle publicity. Each of these divisions will be in charge of a man familiar with the work involved and be conducted along lines similar to the three departments already existing and devoted to committee service, company service, and finance and accounting. It is also proposed to reorganize the control of association affairs through the executive committee so that the different sections of the country shall be represented according to the volume of business done. This places the N. E. L. A. work on a service basis and gives the geographic idea a new meaning. When the matter comes up for final approval at the Pasadena meeting in May in its present form or some better one it should be unanimously adopted. This is a big idea—one that will give to the geographic sections just what they have been looking for and a service they could not render themselves without a great deal of duplication. The details of the plan, now in the hands of a special committee, are looked forward to with a great deal of interest.

The Pacific Coast Spirit

TWO years ago last December the California electrical co-operative campaign was launched to preach the gospel of co-operation both within the industry and to the public. The results of this effort to date have been inspirational. For the year 1920 the sum of $27,000 is being subscribed jointly by contractor-dealers, central stations, jobbers and manufacturers. This sum is made available for expenditure under the guidance of an advisory committee consisting of representatives from all four branches of the industry who meet once a month and discuss campaign operations. Four field agents are employed to go throughout the district, studying merchandising methods and lending a hand here and there in their betterment.

On another page of this issue some of the tangible results of this campaign are set forth that are proving of great present-day benefit to the central station. But the greatest result of this work cannot be expressed in tangible figures. The California co-operative campaign today lends its influence in searching out and holding before the industry new and healthy ideals of electrical service. As a result a better and more enlightened public sentiment prevails, and among all branches of the industry a helpful, co-operative spirit exists that spells value beyond measure to the future growth and prosperity of our industry.

At the present time the California idea is being investigated by a national committee appointed by President Ballard of the National Electric Light Association. This committee has in its membership representatives of all branches of the industry. It will report its findings at the Pasadena convention of the association in May. While it is true that local conditions in other sections of the country will unquestionably require some modification of the California plan, findings of this committee will be generally applicable. The main thing to guard against is not to embrace in any proposed campaign too big a section or community at a time; in other words, so big a section of country that personal contact, both within the industry and with the public at large,

Improvements in Substations and Distribution

WE WONDER what the central-station man of five-and-twenty years ago would have said if he had been assured that his ordinary generating station would presently be working at 13,000 volts and his distribution from substations at 4,000 volts or more. Our account this week of the new Kansas City substations gives a vivid idea of what has really happened. There are many details to which attention may well be directed. Not the least among them is the use of the three-phase, four-wire distribution at rather higher voltage than usual, the pressure between phase wires being 4,400 and from phase wire to neutral 2,540. This means a possible saving of more than 20 per cent in copper above the more usual figures and a corresponding gain in other particulars, a gain all the more important since the fundamental lighting distribution is on derived single-phase circuits. There is probably some reason for this in prior history, since in using the three-phase, four-wire scheme the tendency is to have the courage of one's convictions and carry it through, at least for the chief circuits, clear up to the secondaries.

In the substation arrangements some interesting and useful modifications have been introduced. The 13,200-volt feeders connecting the several substations with the power plant are not tied together, but each delivers energy to its own set of transformers, so that if a cable goes up it is automatically cleared at the generating switchboard with a minimum disturbance of the system. There is also additional security in the form of a reserve cable feeding a reserve bus upon which any set of transformers can be thrown. These reserve buses are of unusual construction, being of stranded, insulated cable installed in fiber conduit and hung from the basement ceiling, with provision for the ready installation of additional cables. In the 4,400-volt bus structure with its necessary provision for many connections a very convenient method of construction was devised. The various compartments are formed of standardized concrete sections cast beforehand to shape and assembled on a concrete base which is cast in place. It is like building up skillfully planned blocks on a table. After everything is in place, smoothly adjusted and fitted, the main retaining wall is cast in place. The plan simplifies construction admirably, and molding the parts in advance gives plenty of flexibility in design.

Thermal Conductivity of Coil Wrappers

IN THE practical service of dynamo-electric machines, especially in large sizes, the limitations to output are found ordinarily in the temperature attained at the hottest spots of the armature conductors in the coil windings. The temperature attained in these windings for any given current strength carried depends upon the thermal conductance of the insulation. If this thermal conductance were very large, the heat would escape from the conductors into the armature, with an indefinitely small temperature elevation above that of the laminated core slots. It would then only be necessary to measure, by thermometer, the temperature in this laminated mass of core body, and the hottest-spot temperature would be identical therewith. On the other hand, the smaller the thermal conductance of the insulation, or the greater its thermal resistance, the greater will be the drop of temperature incident to the flow of heat through it, and the greater will be the temperature elevation of the hottest spots above the surrounding walls of the core slots. It is thus a matter of considerable practical importance to determine the amount of the thermal conductance of the insulating material and the rules which govern it.

The laws of thermal resistance bear a remarkable analogy to those of electrical resistance and may be expressed by an equation like that of Ohm's law. The thermal resistance in a slab of material varies directly as the length of path, inversely as the cross-section, and directly as the thermal resistivity. The geometrical relations of the armature conductors resting in the slots determine the mean length and mean cross-section of the thermal conducting path within fairly narrow limits, so that the thermal resistivity of the material becomes an important residual factor. The lower this resistivity, or the greater the conductivity, the lower will be the temperature drop between the conductor and the external surface. A premium is thus automatically established upon a maximum of dielectric strength with a maximum of thermal conductivity in the insulating material, which must also possess, of course, the necessary mechanical strength and pliability.

Dr. T. S. Taylor describes in an article on page 368 the nature and results of laboratory tests made to measure the thermal conductivity of coil wrappers used in dynamo-electric machines. As the article points out, the numerical values obtained must be expected to vary over a considerable range, owing to the absence of complete uniformity in physical and chemical conditions.

An interesting feature of the report is the appearance of a temperature coefficient of thermal conductivity. It seems that this is positive and about 0.001 per degree centigrade. If this is substantially constant over the ordinary range of temperature, then it may be inferred that the conductivity of the insulation, under rated load temperatures, is about 5 per cent greater than when the machine starts cold.

Dangers of Deferring Maintenance

AN EPIDEMIC of accidents resulting in interruptions to service has broken out in many large and small electric central-station companies. Electrical and mechanical weaknesses are the immediate causes of these troubles, and these weaknesses have developed because the usual program of maintenance and replacement was deferred owing to the war and to the subsequent hesitation over buying apparatus for replacement at high prices. But if the good name of the public utility service is to be safeguarded, this condition of affairs must be remedied at once. Outages and accidents must be reduced. It is better, even at present prices, to replace inadequate or obsolete equipment than to defer the usual maintenance program longer. Hence the immediate future should see many plants thoroughly inspected with the object of marking for rapid replacement apparatus likely to fail. Reliable service must be maintained at any cost. Service is the shibboleth of the industry, and proper maintenance not only makes for increased reliability of service but pays as well. It would be just as unreasonable to expect a full day's work from a weak and starving man as it is to depend for service on crippled equipment.

cannot at all times be maintained. In addition to this, autonomy, or rather self-determination, for the district in which the campaign is inaugurated should be practiced in the highest degree. When all branches of the industry thus feel that the problem is for them to solve together, a certain spirit will come into the work that will make success spontaneous.

Increase of Electrical Equipment

TODAY both the central-station operator and those who supply him are between two fires—the evident need of meeting unusual demands for output and the formidable cost of doing so. Judged by old standards, the situation is abnormal and a little precarious. How shall it be met? To the discussion of this question A. W. Berresford contributes some very judicious suggestions in our current issue. Their wisdom will at once appeal to the reader, and to them we would merely add a brief word of forecast and warning. The war has done far more than to produce extraordinary temporary demands, sudden shifts of front in industrial activity and a wild orgy of inflation from which the world is drunk and dizzy. It has wrought as well changes in purpose and outlook that are likely to have permanent effects. Not the least of these is in our own particular field of electrical industry. The time is now here when manufacturing activity must depend far more than ever before on power and machinery to fill the place of labor the world over—labor decimated by war's destruction and demoralized by war's madness. Mankind must get the maximum of production with the minimum of human effort, that such effort may be conserved for the thousand tasks not yet within the reach of machinery. For this reason we believe that the lessons of electrical equipment taught by the war will not be forgotten and that increases must go swiftly on in plant and shop until there shall be a new balance struck between labor and necessity that will lead to production in the half-deserted fields, leaving the tasks of the shop to those who watch over the almost sentient steel and the all-persuading switch.

Protection Against Line Surges

IT IS a familiar fact that surging in its various unpleasant varieties on transmission systems is an ever-present problem and sometimes becomes very unexpectedly a serious impediment to continuous operation. Lightning is bad enough, but it is confined to certain seasons and can be dealt with by means of ground wires and electrolytic lightning arresters with at least a fair degree of success. Surging, however, often manifests itself at unprotected spots and to very unexpected degrees. Wherever on a power transmission system there is, so to speak, a partial discontinuity in the electro-dynamic conditions there is a chance for sudden rises of voltage which if conditions are favorable may prove very mischievous. Our readers will therefore be particularly interested in the article by C. E. Bennett in this issue on a species of surge valve which he has developed to meet these abnormal voltages. The general scheme is a very simple one—a horn-gap connection to ground through an automatically interrupted resistance. The horn gap is set much closer to the normal maximum line voltage than would be the case with the lightning arrester, and in so far suggests the branch circuit to ground from an arrester which has long been in use. The specially striking feature of Mr. Bennett's development is the means taken for providing a resistance which automatically breaks the circuit and then restores itself to its original condition. The sketches published with the article show admirably just how this is accomplished.

Simplicity is a marked characteristic of this device, and, judging from the oscillogram, it is exceedingly effective, breaking the circuit in a tenth of a second or so and very quickly resetting the surge trap for further use. The same apparatus also operates as a lightning arrester, tending then to produce a break-down of the dielectric strength of the liquid and ground the circuit, followed at once by normal functioning of the apparatus and the interruption of the discharge. The automatic break undoubtedly gains effectiveness from being in series with a permanent gap and evidently might be conveniently used with a series of horn gaps or non-arcing cylinders, or as a shunt to earth at some point of such a series. The practical question of attention does not appear to be a serious one as the break is quick enough greatly to lessen the danger of smashing the tube or seriously damaging its insulating powers. A change in the electrolyte, or for that matter the tube length, readily varies the ground resistance, and obviously the stability of the resistance in use can easily be tested by measurement between the electrode and the case. Altogether the device looks very promising, and it should provide a ready means for getting rid of surges, one of the very considerable annoyances of practical power transmission.

Quality Versus Cheap Products in Oriental Markets

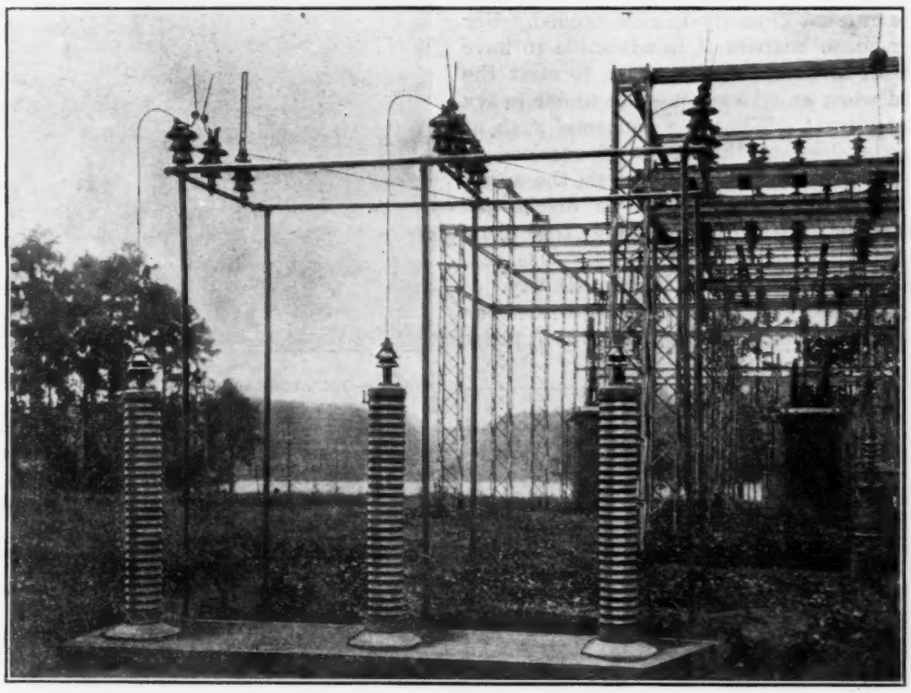
AN EMINENT authority on world trade, Julian Arnold, United States commercial attaché at Peking, China, in a recent public address in San Francisco directed attention to an important feature of our present commercial policy abroad which reflects decided credit upon the methods of American business leaders. Commenting on the export efforts of a leading American electrical manufacturing concern, Mr. Arnold stated that this company, though conducting a substantial and ever-expanding busines in China, is in no wise lowering the standards of its products, keeping them as high as those prevailing in this country. That this policy has proved successful, he said, is evidenced by the confidence displayed in these electrical wares by the Chinese, who appreciate quality as well as people of other nations.

It is a noteworthy fact that American "quality products," such as high-class electrical machinery, are able to hold a good share of the trade in the Oriental field, which is sometimes disparaged as "a cheap market." American goods are accomplishing this despite the keen competition and underselling of the manufactured products of Japan and other countries. The maintenance of a consistent quality standard on which dependence may invariably be placed is what makes this condition possible. It is gratifying to have an authoritative statement regarding this adherence to American manufacturing tradition in our world trade, and better still to know that the electrical industry is once more leading the way. Best of all, this sound policy is getting the business.

Protecting from Abnormal Voltages

Construction and Operation of a Surge Arrester Designed to Protect Generating and Transmission Systems from Abnormal Potentials Caused by Lightning, Switching, Arcing Grounds, Etc.

By C. E. BENNETT
Special Engineer Georgia Railway & Power Company



A SURGE ARRESTER INSTALLATION ON THE LINES OF THE SOUTHERN POWER COMPANY AT CHARLOTTE, N. C., OPERATED AT 44,000 VOLTS DELTA-CONNECTED. THIS IS THE COMPANY'S MAIN DISTRIBUTION STATION IN THAT DISTRICT, IN THE HEART OF ITS SYSTEM

SEVERAL years ago experiments were undertaken by the writer with the object of developing a lightning arrester—or, more accurately, a surge arrester—which would offer a high degree of protection to transformers and other station apparatus without incurring heavy maintenance charges for the arrester itself. The electrolytic arrester was, of course, available, with the ideal discharge characteristics which this apparatus affords; but equipment was desired which would be low enough in first cost to be available for small substations and still be free from troubles previously experienced on the horn gap and resistance type of arrester ordinarily used for small installations. As the result of a large number of experiments and field tests, a surge arrester has been developed in various sizes to meet all practical requirements for any service up to 110,000 volts.

This surge arrester is designed on the principle of using water as the medium to absorb and dissipate the energy of the discharge and automatically extinguish the arc. While intended primarily to relieve direct or induced potentials from lightning disturbances, it has been found that the equipment is equally efficient in relieving surges from any other cause, such as switching, arcing grounds, flashover of insulators and like occurrences.

The apparatus consists essentially of a horn gap and a resistance element mounted as a complete unit. The horn gap is connected directly to the line, while the resistance element or liquid surge arrester is connected between the horn gap and the ground. This liquid surge arrester consists of a metal tank filled with a water solution or electrolyte of proper density, with a heavy porcelain or glass tube mounted therein, as shown in Fig. 1, so that the long column of water inside the tube serves as the resistance element.

As shown in Fig. 1, the tube inside the tank is open to the electrolyte at its lower end, the upper end extending above the electrolyte and through the top and above the tank. The electrolyte entering the bottom of the tube comes to the same level as that in the tank surrounding the tube. Extending from the top of the tube and connected to the horn gap is a metallic conducting rod, the end of which is slightly submerged and in contact with the electrolyte inside the tube. The metallic tank of the apparatus is connected to the ground circuit and forms the ground electrode of the apparatus. The electrolyte, in addition to its other more important functions, serves as a primary limiting resistance to ordinary line discharge across the arrester.

Adjustable Discharge Rate Conforms to Line Capacity and Loading

The water resistance of this liquid surge arrester functions as an automatic circuit breaker whenever current is discharged through it. Its internal resistance is

John W. Lieb

An executive-engineer whose services to the industry date from the establishing of central-station service in New York City

WHEN the famous Pearl Street station was started in New York City on Sept. 4, 1882, John W. Lieb held the position of electrician, secured through rare experience in conducting tests on the Jumbo generators in that station. Later he was chosen to carry this knowledge of the Edison system to Italy, where he supervised the introduction of underground systems for the Italian Edison Company. In 1894 he returned home to become assistant to the first vice-president of the Edison Electric Illuminating Company, continual promotions leading him to his present office—that of vice-president of the New York Edison Company. Merely to recount these facts, however, gives no real idea of Mr. Lieb's relation to the electrical industry. His wide influence and untiring activity are better indicated by the unremunerative offices he has held, which include the presidency of the Association of Edison Illuminating Companies, the National Electric Light Association, the American Institute of Electrical Engineers, the New York Electrical Society and the Edison Pioneers. In the N. E. L. A. he has been a directing and controlling force, serving since 1914 as a member of the public policy committee and acting as the representative of the association in the National Industrial Conference Board. When the United States entered the war the leaders of the industry found a new outlet for Mr. Lieb's energy. Together with the others he grasped at once the important part the central station would have to fill in the struggle and the necessity for preparedness. Throughout the war he was chairman of the National Committee on Gas and Electric Service, and under his guidance, with the co-operation of other strong minds, the utilities rendered a loyal and absolutely essential service to the war industries that impelled national recognition. He is a man with both the power to conceive and the energy to execute plans of action, one of an outstanding group of men who are continually setting new standards for the electrical industry. On Thursday of this week Mr. Lieb celebrated his sixtieth birthday.

so graduated for different voltages that the highest possible discharge rate is secured for any impulse or excessive potential which may be superimposed upon the lines connected to it, but is such that the subsequent flow of dynamic current following a discharge to ground will not disturb the operation of the system. The exact resistance of each unit may be changed as desired by simply changing the density of the solution.

In most cases the requirements are for an equipment which will discharge waves of excessive potential, but in some cases large current capacity is also needed. For service on power-house busbars it is advisable to have a surge arrester of large current capacity to meet the conditions caused when an oil switch opens under heavy overload or short circuit. When the abnormal rush of current from generators to the point of overload is interrupted instantaneously by the oil switch, the excessive potential and currents will then be discharged through the arrester instead of causing the usual trouble at the switch. The arrester in this case acts as a relief valve, protecting the switch from injury.

The surge arrester of the design under discussion provides a high-capacity discharge path from each phase

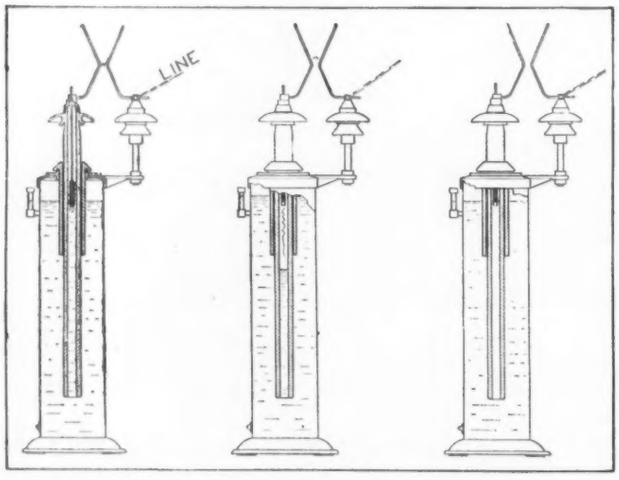


FIG. 1—DETAILS OF CONSTRUCTION AND THREE STEPS IN THE CYCLE OF OPERATION OF THE SURGE ARRESTER

to ground, and its tapered discharge provides additional protection. In removing such a discharge the arrester carries a maximum current during the first few cycles, and as the arc is drawn out the current is uniformly reduced until it is finally extinguished in approximately one-tenth of a second. The oscillogram shown in Fig. 2 is from an actual test made to show the flow of dynamic current which followed a discharge, with the horn gaps set for 25 per cent over line voltage, the gaps being short-circuited to cause the discharge. The tapered action of the discharge is shown in this oscillogram.

At the instant of discharge the steam formed by the electrode comes in contact with the water column. The steam in expanding creates a pressure which immediately drives the column of water downward, drawing out the arc inside the cold tube, as shown in the center illustration of Fig. 1. This automatically extinguishes it within a few cycles without causing any interruption to service on the line. When the arc is extinguished the water immediately rises, being drawn upward very rapidly by the vacuum formed, and the arrester is restored to normal condition as shown in the illustration at the right in Fig. 1. To prevent unnecessary evaporation the main body of the liquid is covered by a thin layer of oil. A suitable gage is provided so that the liquid can be readily observed and more water can be added easily if necessary.

The cross-section views of a 33,000-volt equipment in Fig. 1 show the cycle of operation of the surge ar-

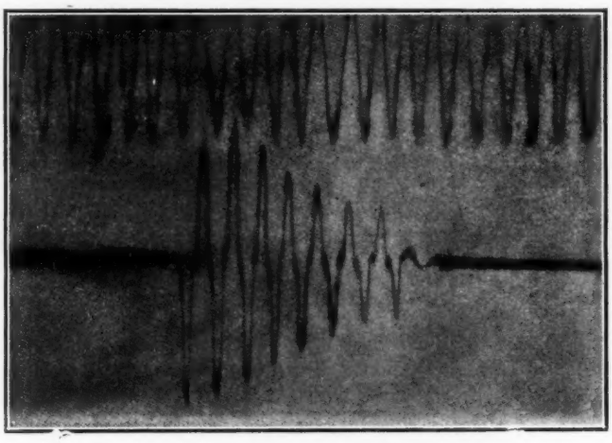


FIG. 2—OSCILLOGRAM SHOWING NORMAL DISCHARGE OF SURGE ARRESTER FROM AN ACTUAL TEST MADE WITH THE HORN GAPS SET FOR 25 PER CENT OVER LINE VOLTAGE, THE GAPS BEING SHORT-CIRCUITED TO CAUSE THE DISCHARGE

rester. The sphere or horn gap is set usually to between 15 and 25 per cent above normal line votage. If the potential rises above this value, the gap fires and automatically drains the line of the abnormal potential through the interrupter.

In discharging a lightning disturbance the action of the liquid interrupter is somewhat different from its behavior on line disturbances caused by normal operation. The liquid or electrolyte contained in the interrupter has a certain definite dielectric value. The potential of the lightning flash is so high and so suddenly applied that the dielectric strength of the liquid is broken down and the liquid punctured, giving a free path through the liquid of small resistance directly to the ground. The generated or line current immediately follows, but before it has reached any great value the dielectric strength of the liquid is automatically re-established, having healed and closed the opening or path caused by the lightning discharge, and the appartus then works as under normal discharges as follows:

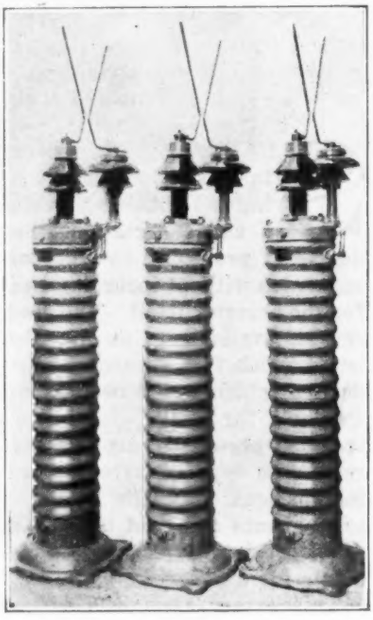


FIG. 3 — A SET OF SURGE ARRESTERS FOR OPERATION ON A THREE-PHASE SYSTEM AT 38,000 VOLTS

The line current having once crossed the sphere or

horn gap passes through the stem of the upper electrode and into the electrolyte at the contact between the upper electrode and the electrolyte inside the tube. This rapidly causes the production of a heated vapor which in turn produces sufficient pressure in the chamber above the electrolyte to cause the electrolyte to recede from its contact with the upper electrode and to draw an arc between that electrode and the surface of the electrolyte, this arc being greatly attenuated by the continued receding of the surface of the electrolyte within the tube. The arc is then extinguished within the tube of the interrupter and on the external air gap.

The extinguishing of the arc within the interrupter takes place almost instantaneously, under normal conditions. Its operation is accomplished by the application of two fundamental principles, the first being obviously the attenuation or drawing of the arc and the second being the more active principle and considerably more complex. To grasp the action or application of this second principle, it must be remembered that the tube is submerged in a liquid of high heat absorbing and conducting capacity, the electrolyte being principally composed of water. This serves rapidly to convey and absorb the heat of the arc generated within the tube by keeping the tube cold, the heat being conducted through the tube into the liquid surrounding it, and the heat is also absorbed by the production of steam within the tube. A marked amount of heat energy becomes latent during the steam-producing operation. The arc is then extinguished in a similar manner to that of any other flame. The water or electrolyte is in direct contact with the arc, giving it an atmosphere of steam through which to pass. The steam, in addition to its own energy consumption during its formation, provides a medium for the heat transference to the tube. The tube, being of porcelain or glass, provides a path of high heat-conducting capacity to the cold electrolyte surrounding it. In this manner a chamber is established in which the arc is attenuated, because it is too cold for the arc to be maintained, the heat of the arc being more rapidly absorbed than it is propagated. Therefore the basic principle of the operation of this apparatus is one involving the thermodynamics of its action.

PRINCIPLES ON WHICH ARRESTER OPERATES

An arc when once formed is largely maintained by the volatilization of the metallic terminals from which the arc is sprung. In this apparatus only one terminal is metallic, the other being the surface of the water. The metallic or conducting vapor from the other terminal is immediately condensed, because of the comparatively cold, heat-energy-absorbing medium through which it passes, and it therefore does not increase the conductivity of the arc path. All of these heat-absorbing operations assist in extinguishing the arc flame, and as every action is nearly instantaneous the arc is almost immediately interrupted after once forming within the tube of the interrupter.

The upper end of the tube is nearly closed, a small vent hole being left in the tube cap the function of which is to restore the position of the surface of the liquid within the tube. If the vent is not included, the surface of the electrolyte will rise above the normal position. A certain amount of vapor or air having been expelled

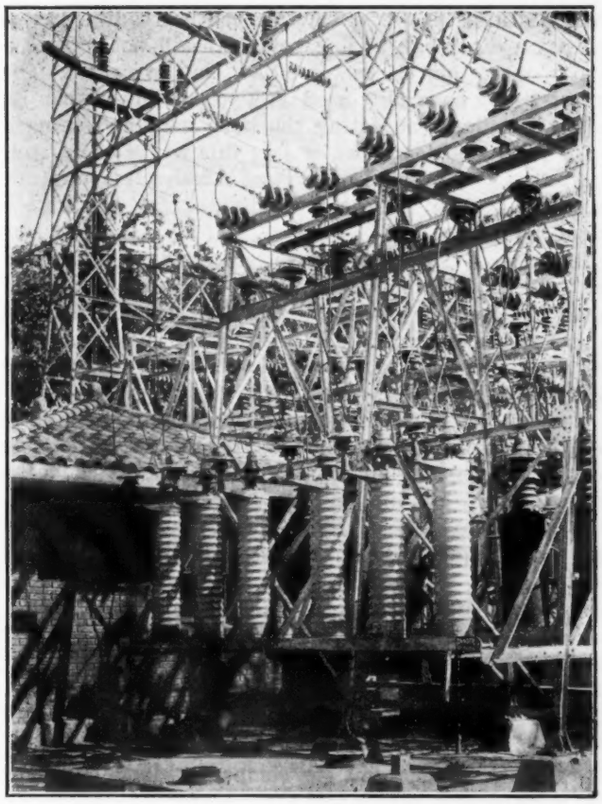


FIG 4—TWO SETS OF THREE-PHASE SURGE ARRESTERS INSTALLED AT THE NORCROSS (GA.) SUBSTATION OF THE GEORGIA RAILWAY & POWER COMPANY OPERATED AT 38,000 VOLTS Y-CONNECTED

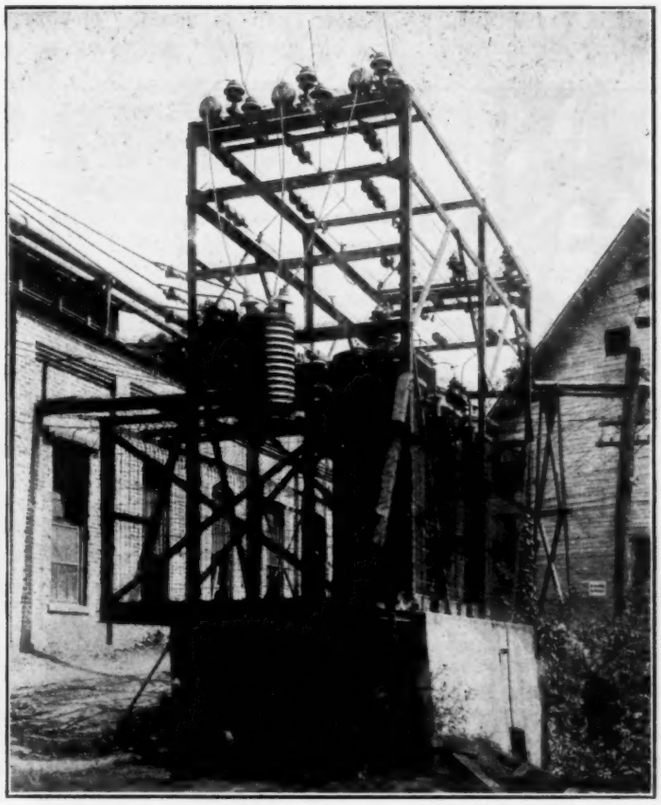


FIG. 5—A THREE-POLE, 19,000-VOLT Y-CONNECTED SURGE ARRESTER INSTALLATION AT A SMALL SUBSTATION ON THE TRANSMISSION SYSTEM OF THE GEORGIA RAILWAY & POWER COMPANY

in the operation of the interrupter, the space previously occupied by this air or vapor is filled with steam. The condensation of this steam takes place almost instantaneously following the interruption of the arc, and a partial vacuum is established in the expansion chamber above the surface of the electrolyte. This vacuum, plus the difference in hydrostatic head between liquid within the tube and that surrounding it, serves to immediately re-establish the contact between the upper electrode and the electrolyte by causing the electrolyte to rise quickly within the tube. The apparatus is thereby reset for a succeeding discharge.

The mere attenuation of an arc within the tube or in the presence of air or a similar gas, or a vacuum, does not have a great tendency to interrupt the arc path. This is particularly true of arcs sprung in air or in other gas, or in vacua which are not surrounded by a tube.

The arc drawn by a horn gap is usually blown out by air movement, this air movement supplying to

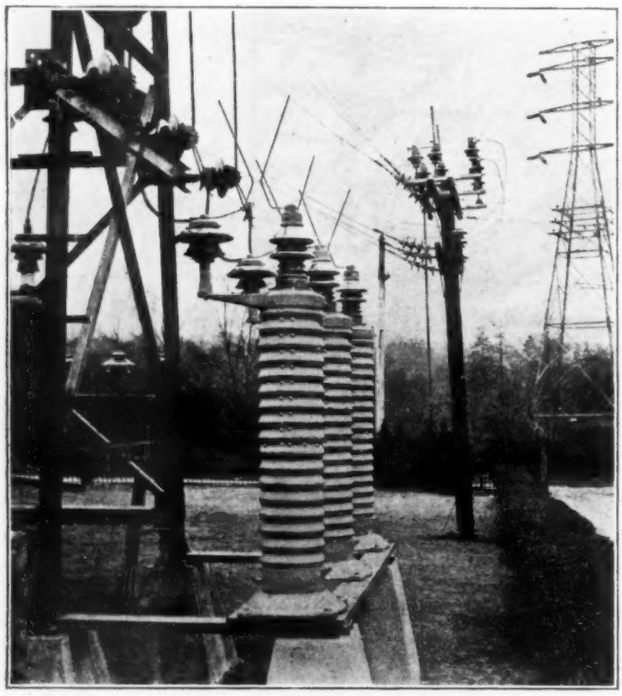


FIG. 6—AN INSTALLATION OF SURGE ARRESTERS ON 38,000-VOLT CIRCUITS AT THE BOULEVARD SUBSTATION IN ATLANTA OF THE GEORGIA RAILWAY & POWER COMPANY

a small extent the cooling operation which tends to extinguish the arc during its attenuation. If the terminals of a horn gap are sufficiently heated by the passage of the arc, the arc once blown out by air movement will re-establish itself across these heated terminals and the operation of blowing it out will be repeated. If the arc is drawn in a vacuum, it will continue until the current flow is interrupted from some external cause or until the terminals are melted.

These conditions are recited to bring out the fact that the almost instantaneous extinguishing action of the arrester is due solely to the heat-absorbing action, the attenuation of the arc in the tube only serving to bring the arc path into greater contact with the cooling action of the medium surrounding the arc and the tube.

Many tests have been made under abnormal conditions to determine the real capacity of the equipment, and the results have been highly satisfactory. Units have been connected to the line with the horn gaps set at less than line voltage. Under these conditions, as soon as one arc is broken another is re-established, and the result is a continuous stream of discharge. No surges on the system are caused on account of the tapering way in which each discharge is interrupted. The only result is to evaporate a small amount of water. Other tests have been made with solutions of such low resistance that the mechanical reaction has overturned the tank. Even under these conditions electrical operation was found normal and no damage was done to the arrester, nor did the service on the system suffer any interruption.

For regular service a high discharge rate is preferable as this gives high-voltage surges a low-resistance pass to ground. In certain locations a discharge of 100 kw. or 200 kw. at line voltage is undesirable, and for such locations the water solution can be readily varied, so that a discharge at line potential will not impose a load of more than 25 kw. or 50 kw. on the system. The arrester may be readily used on a voltage lower than its rating by simply adjusting the horn gaps and using a more dense solution of water. In this way a 44,000-volt equipment can be used to protect 6,600-volt apparatus, and later it may be easily readjusted for the higher voltage.

Designs of surge arresters are now in operation for voltages of from 2,300 to 110,000, and two other types will soon be placed in operation, one for 140,000 volts and the other for 1,500 volts direct current street-railway service. A small electric heater is used to prevent freezing of these arresters in cold weather.

For use on power-house busbars the arresters are designed to discharge 500 kva. to 1,000 kva. at line voltage. Such an equipment acts as a safety valve on the system for any high-voltage surge caused by switching disturbances or similar troubles, with the result that the damage which is caused by heavy overload conditions or by short circuits on overloaded lines is very largely reduced.

Byllesby Customers Took $3,387,100 Preferred Stock

THE six electric and gas companies under Byllesby management, which sold their preferred stock direct to the public served by them during 1919 distributed $3,387,100 par value of such stock during the year, there having been 5,700 separate sales. This was an average of almost $600 par value per sale. At Louisville, Ky., the sales represent a period of only about forty-five days, the offering being first made about the middle of November. At a number of the properties there were no special drives or selling campaigns, while the San Diego company has had no preferred stock available for sale for several months.

Results for the year for the various companies were as follows:

Company	Number of Sales	Par Value Preferred Stock
Northern States Power Company	4,314	$2,479,700
San Diego Consolidated Gas & Electric Co.	212	287,900
Louisville Gas & Electric Company	494	224,700
Arkansas Valley Railway, Light & Power Company	305	183,500
Oklahoma Gas & Electric Company	278	151,600
Western States Gas & Electric Company	97	59,700
	5,700	$3,387,100

Thermal Conductivity of Coil Wrappers

Test Specimens Are Wrapped Upon a Heating Element According to Standard Coil Specifications —By Measuring the Power Required to Heat the Insulation and the Temperature Rise the Thermal Conductivity May Be Determined

By T. S. TAYLOR

Research Laboratory Westinghouse Electric & Manufacturing Company

IN ORDER to deal with the dissipation of the heat generated in electrical machinery, it is very important to know the value of the thermal conductivity of the insulation surrounding the coils. It is entirely possible to measure this quantity for those components of the insulation by a direct process such as was done by the author for a large number of materials.* However, one cannot make absolute use of these values when the materials are put in the form of coil wrappers, for the reason that the method above cited attempts to avoid discontinuities and air pockets entirely, while in coil wrappers this would be entirely impossible. Neither can accurate assumptions be made as to the rôles played by insulation, air pockets and discontinuities in the forming of a coil wrapper. Consequently it seemed highly advisable to measure the thermal conductivity of coil wrappers made up according to the specifications used when they are being constructed for actual machines. The work herein described was undertaken with this object in view. Since the difficulties encountered in making conductivity measurements on coil wrappers *in situ* are considerable, it seemed that reliable data could be secured by making

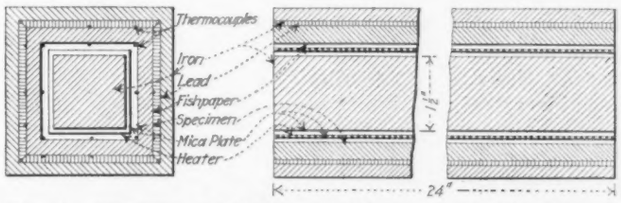


FIG. 1—SECTIONS SHOWING MOUNTING OF INSULATION ON HEATING ELEMENT TO GIVE EQUI-TEMPERATURE SURFACES

measurements of the thermal conductivity of the insulations when wrapped according to the usual specifications about heaters having dimensions of the same order of magnitude as the coils, provided that the heater with the surrounding insulation was placed in an iron box imitating the slots in electrical apparatus. After making numerous attempts to construct a suitable apparatus, it was found that the one described below and illustrated in Fig. 1 was entirely satisfactory.

Method of Mounting Insulation on the Heating Element

The core of the heater was an iron bar 1½ in. x 1½ in. x 24 in. (3.8 cm. x 3.8 cm. x 61 cm.). This was used in order to insure the rigidity necessary when having the insulations wrapped about the heater. A layer of special heater mica $\frac{1}{16}$ in. (2 mm.) thick was pressed over the iron bar, and the heater wire, No. 21, constantan, was wound around the bar over the mica so as to have eight turns to the inch. The space between the turns of wire was filled with asbestos cement, and then a second layer of $\frac{1}{16}$-in. mica plate and thin sheet asbestos was put over this. The heater thus constructed was placed in a form, clamped securely and thoroughly dried out by sending current through the heater wire. The outer surface of the mica plate over the heater wire was raised to a tempeature of about 250 deg. C. so that any subsequent heating while under test would make no additional changes due to further drying out of the materials in the heater insulation. After the heater was thoroughly dried out, small thermocouples, eight in all, composed of 0.005-in. (0.013-mm.) copper and constantan wire were placed as shown in Fig. 1 at the mid-section of the heater. Two thermocouples were placed on each side of the heater, one at the center of the side and another near the edge. The thermocouple wires were run out along the bar its entire length, all the copper wires to one end and the constantan wires to the other end. A cap was placed over the ends of the thermocouple wires, after they were coiled up together at each end in order to protect them from injury during subsequent handling of the heater. The insulation to be tested was wrapped about the heater according to the desired specifications by those well accustomed to doing such work.

After having the insulation put on the heater a layer of 0.007-in. (0.018-mm.) fish paper was wrapped over the insulation for those cases where this was the usual practice. Thermocouples were attached to the fish paper at positions corresponding to those under the insulation and after placing a layer of cotton tape for insulation purposes around the whole it was inclosed in a lead sheath and then forced into an iron box of such dimensions as to make it fit quite tightly. The lead sheath was put about the heater, etc., in order to secure a nearly constant temperature surface.

Taking Temperature Measurements

The iron box containing the heater was set up in the open. After straightening out the thermocouple wires and joining them to suitable switches, the ends of the apparatus were covered loosely with felt so as to prevent any great loss of heat from its ends. A cold junction was inserted in the thermocouple circuits so that the temperature could be measured at each position by means of a thermocouple potentiometer. The energy for the heater was supplied by means of a storage battery, the current being measured by means of an ammeter previously calibrated. Readings of the ammeter were checked up frequently by measuring the potential drop through a standard low resistance placed in series with the heater by means of the potentiometer. The total potential drop through the heater was determined by measuring the drop through a definite portion of a standard high resistance placed in parallel with the heater. The energy consumed per unit length of the heater could then be very readily calculated from these determinations. This assumes that the fall per unit length of the heater wire is constant and that the winding was quite uniform. This cannot be in error

*"Thermal Conductivity of Insulating and Other Materials," *Physical Review*, 1919; *Electric Journal*, 1919.

since the heater wire was constantan. Furthermore, the iron core would tend to equalize any temperature differences that might arise. This method further assumes that the flow of heat at the middle of the apparatus was at right angles to its length and that whatever heat was lost from the ends of the bar had no influence upon the temperature at the middle of the bar. That this latter case is true is without question since there was but very little heat dissipated through the well-insulated ends, and furthermore the heater was of such length that a temperature could exist near the ends differing considerably from that in the middle and not change the temperature at the middle, the same amount of heat being generated per unit length of the heater throughout its entire length.

It was found quite satisfactory to assume that the iron box surrounding the apparatus constituted an equi-temperature surface when placed in the open in the room. The ordinary variations in room temperature were insufficient to affect this when care was taken to avoid useless air currents. Before taking a set of measurements of the energy consumed per unit length of the heater and the mean temperature drop through the insulation, sufficient time was allowed for heating up in order that temperature equilibrium could be established. The average drop in temperature through the insulation was determined by taking the difference between the temperature as measured by the eight thermocouples on the outside of the insulation and the eight thermocouples on the inner side of the same. In addition to having this drop in temperature through the insulation, its mean thickness as determined from average measurements over the heater before and after the wrapper was put on, and the heat generated and passing through unit length of the wrapper, it is necessary to know the shape factor for the heater before being able to calculate the thermal conductivity of the wrapper.

The shape factor, which is the ratio of the area to the thickness, is calculated as follows: We assume, as an experiment proved to be true, that the inner and outer surfaces of the insulation under test were equi-temperature surfaces and did not differ from regular figures. Let $2a$ and $2b$ be the dimensions of the apparatus just under and over the wrapper under test. Let x be the distance of the surface A as measured from the center of the bar perpendicularly to one side. H is the total heat flowing through the insulation per unit length of heater. Now, the flow of heat $dH = (A/dx)kdt$, where k is the thermal conductivity of the material, dt the change in temperature, dx the thickness of the element and A the area through which the heat is flowing. This area A is the area of the surface per unit length of the heater at a distance x from the center as shown in Fig. 1 and is consequently equal here to $8x$.

$$\text{Therefore } H = \frac{\int_{t_2}^{t_1} k\,dt}{\int_a^b \frac{dx}{8x}} = \frac{8k\,(t_1 - t_2)}{\log b/a}$$

But $H = Sk(t_1 - t_2)$ and hence the shape factor $S = \frac{8}{\log b/a}$ per unit length of heater. The thermal conductivity of the material is then readily seen to be given by

$$k = \frac{H \log b/a}{8\,(t_1 - t_2)}$$

$$= \frac{IE \log b/a}{8\,(t_1 - t_2)} \text{ watts/unit length/deg. C./sec.}$$

I and E represent the current in the heater and the potential drop per unit length of the heater respectively

Preliminary Heating to Remove Moisture

Upon first heating up a newly applied wrapper it was found that its thermal conductivity changed considerably with continued heating but finally settled down to a definite value so long as the mean temperature did not exceed that used in the initial heating. Hence, in order to secure consistent results, it was found necessary to dry out the sample thoroughly by giving it a long preliminary heating at a temperature considerably in excess of that for which it was guaranteed. A preliminary heating of sixty hours at an average temperature of 210 deg. C. was found adequate to dry out the wrapper thoroughly, so that subsequent heatings to the guaranteed temperature, 135 deg. C. to 150 deg. C., produced no further change in the thermal conductivity. The statement in the table concerning the 11,000-volt treated cement paper and mica hand wrapper shows the behavior of all freshly prepared wrappers during the preliminary heating.

Thermal conductivity measurements were made in the manner outlined above for various coil wrappers and of voltage requirements from 4,500 to 13,200. Considerable difference was found to exist between the values obtained for different samples of the same material and voltage requirements. Such differences are due to the fact that there are many uncontrollable factors entering to influence the final value attained by a given wrapper. This would not be the case if it were possible exactly to duplicate the conditions arising in the construction and curing out of the wrapper. In the first place, the wrapper is a more or less conglomerate preparation, and there is little chance of being able to secure homogeneity in its composition. The conditions under which it is manufactured even before being formed on the coil preclude this. To duplicate the distribution and surface area of the air pockets and contact surfaces which arise during the forming and drying out of the wrappers is entirely out of the question.

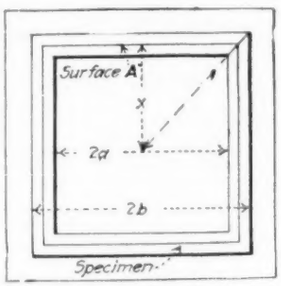


FIG. 2 — DIMENSIONS USED IN MATHEMATICAL DISCUSSION

The large variations in the value of the thermal conductivity are due chiefly to these latter causes.

Some Difficulties in Determination of Temperature Coefficients

The results given in the table on page 370 are typical. Three or more significant figures are given for each case in order to give some little significance to the temperature coefficient where it seemed possible to calculate it. For those cases having no temperature coefficient it is quite likely that the increase in the thermal conductivity of the material forming the wrapper is counterbalanced by the increase in the thermal resistance of the sample as a whole due to the increase in the imperfectness of contacts between the constituents as the temperature increases. To calculate the most probable value of the thermal conductivity for a given wrapper from results such as are given in the

table would require an exceedingly large number of tests on different samples of the same wrapper. This procedure is scarcely advisable since it is by no means possible to control conditions so that any given sample can be exactly duplicated.

While the results herein given for a given wrapper do not agree closely with each other, they do present quite interesting facts. In the first place it is evident that whatever influence the insulating wrappers may have upon the temperature of electrical machinery cannot have ascribed to it a definite value which can be used in all cases. It is seen that the thermal conductivity of a given material in the form of a wrapper may differ as much as 50 per cent. It may be better than it is usually assumed to be, and on the other hand it may not be nearly so good. In the former case the

THERMAL CONDUCTIVITY OF COIL WRAPPERS

Wrapper	Temp. Deg. C.	Number of Thicknesses	Conductivity k, Cal./ Cm./ Deg. C./ Sec.	Watts/ in / Deg. C./ Sec.	Temp. Coeff.
6600-volt hand wrapper....	30	..	0.0C0234	0.00248	.....
Treated cement paper and mica.....	30-140	5	0.000261	0.00237	0.0010
6600-volt hand wrapper....	30	..	0.000228	0.00242	.....
Treated cement paper and mica.....	30-160	5	0.000257	0.00273	0.0019
11,000-volt hand wrapper.	30	..	0.000375	0.00399	.....
Treated cement paper and mica*.....	30-150	9	0.00396	0.00421	0.0010
11,000-volt hand wrapper.	30	..	0.000290	0.00308	.....
Treated cement paper and mica.....	30-160	9	0.000306	0.00325	0.0008
11,000-volt hand wrapper.	30-160	9	0.000270	0.00287	None
Treated cement paper and mica. Same wrapper impregnated with 260 deg. gum.....	30-160	9	0.000300	0.00319	None
13,200-volt hand wrapper..	30	..	0.000403	0.00427	.....
Treated cement and mica..	30-160	11	0.000419	0.00446	0.0006
13,200-volt hand wrapper..	30	..	0.000208	0.00221	.....
Treated cement paper and mica	30-160	11	0.000235	0.00250	0.0010

effect will be on the safe side, but in the latter the opposite is true. The influence of air films and imperfect contacts produced during the forming of the wrapper and its drying-out process is quite noticeable. The average value of the thermal conductivity of treated cement paper and mica hand wrappers is approximately 0.00030 cal./cm./deg. C./sec. The value* found by the author for the sheet material when air pockets and films were practically avoided was 0.00045 cal./cm./deg. C./sec. These facts show quite clearly the futility of designers holding too closely to definite figures in regard to the values of the thermal conductivity of the wrappers as they now exist in practice. This will not be the case, however, when it is possible to make coil wrappers having definite characteristics instead of variable ones such as appear from the results given by the present work.

**Physical Review*, 1919; *Electric Journal*, 1919.

TAKE *an interest in the things which are interesting to the whole, remembering that money is not everything, remembering that the keynote of life is service, and that there is a greater opportunity for service in our homes and abroad than ever has been before. We should not be true to the memory of those we serve today, if we did not attempt to carry on the great principles for which they died and for which our Constitution stands.*—JOSEPH B. MCCALL.

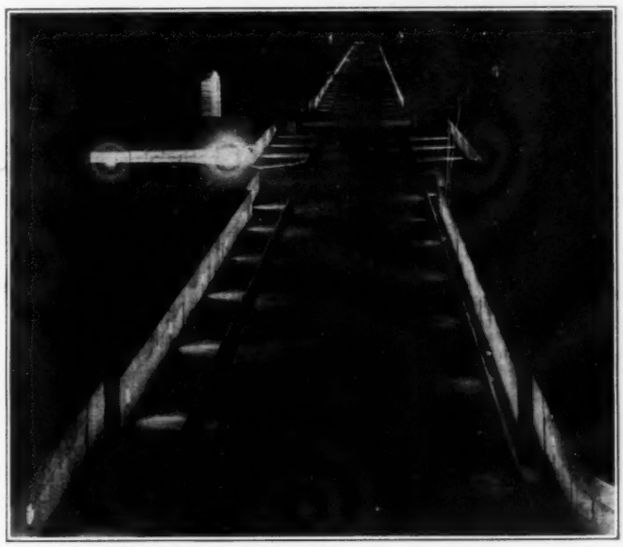
Mounting Units for Lighting Dam

Roadway Evenly Illuminated by Use of Boxes Containing Headlight Lamps Set Into Parapet Wall 26.5 In. Above Roadway

THAT roads can be lighted without the use of poles has been demonstrated by the installation of low-mounted lighting units to illuminate the roadway across the Kensico Dam, built across the Bronx River about 3 mi. (4.8 km.) north of White Plains, N. Y. The roadway is brick-paved, 26 ft. (8 m.) wide, is bordered on one side by a sidewalk about 4 ft. (1.2 m.) wide, and it runs between cut-stone parapets approximately 4 ft. (1.2 m.) in height.

The openings in the stonework for the lighting units are approximately 13½ in. (35 cm.) square and 15 in. (40 cm.) deep. The center of each opening is 26½ in. (67 cm.) above the surface of the roadway, and the openings are approximately 37½ ft. (11 m.) apart on each side of the roadway, with a staggered arrangement of spacing.

A cast-metal frame with a hinged door which can be



ADEQUATE ILLUMINATION WITHOUT GLARE IS OBTAINED WITHOUT FIXTURES

locked was made to fit in this opening. A sheet of vertical prismatic glass is held in the door by three vertical and three horizontal cast-in bars, each ¼ in. (6 mm.) wide and ½ in. (13 mm.) deep.

Six-volt, 108-watt gas-filled headlamps are used for the illumination, but as these lamps have a comparatively short life on normal operating conditions, only 5.5 volts is applied to them in order to reduce the maintenance cost.

In distributing the light so that it would not be objectionable from the standpoint of glare, it was found necessary to make each unit throw sufficient light on the opposite parapet wall to relieve the contrast between the light source and the adjacent wall. Thus satisfactory results have been obtained with an energy consumption of approximately 5 watts per running foot (16.5 watts per m.) of roadway. This installation, which was made by the Lord Electric Company, was described in a paper which C. A. B. Halvorson and A. B. Day presented before the thirteenth annual convention of the Illuminating Engineering Society in Chicago.

Estimate of the Cost of Hydroelectric Equipment

Unit and Total Data Based on 1918 Reproduction Costs in Vermont Appraisal Afford Interesting Comparisons

IN connection with the proposed consolidation of several hydroelectric properties in Vermont an exhaustive appraisal was prepared recently in which the reproduction cost of the new equipment installed as under 1918 conditions was set forth. From analysis the unit and total probable costs of various plant structures of interest to the hydroelectric engineer are frequently apparent.

Although the data are somewhat irregularly set forth, their suggestiveness under the present scale of construction costs renders them of unusual interest, and they are printed in the following table for the use of engineers who are concerned in particular with hydroelectric work on a small or moderate scale. If the data are not final, they none the less afford ground for interesting comparisons.

1918 REPRODUCTION COSTS OF HYDROELECTRIC SYSTEM EQUIPMENT

Power-plant building, brick, concrete and masonry foundations, 60 ft. by 142 ft. by 18 ft.	$34,500
Log crib dam, 100 ft. long, 12 ft. high, 445 cu.yd. at $5.60	2,492
Canal wall, stone masonry, 107 ft. long, 150 cu.yd. at $6.00	900
Frame gatehouse, 11 ft. by 32 ft. by 9 ft., peak-shingled roof, erected on canal wall abutments	200
Garage and machine shop, brick on concrete foundation, 49 ft. by 28 ft. by 13 ft. wood roof, concrete floor	3,800
Power-plant building, brick and concrete structure, 73 ft. by 41 ft. by 28 ft., with transformer room extension, 18 ft. by 15 ft. by 18 ft.; dispatcher's room with brick partitions, 9 ft. concrete basement, with heavy concrete columns supporting generator-room floor, concrete wheel-fit arches and foundation, steel-roof trusses, slate roof	36,000
Operators' frame dwelling, two stories and basement, eight rooms at power-house site	4,500
Frame storehouse, sheet-metal covering, 12 ft. by 16 ft. by 9 ft. to eaves, peaked roof, felt-paper covering, wood floor, at power-house site	125
Frame garage, 12 ft. by 16 ft. by 8 ft., tar-paper covering over board sides	75
Brick fire hose house, 8 ft. by 6 ft. by 10 ft. concrete base, with hydrant and 250 ft. of 2½-in. hose	290
Concrete spillway dam; spillway 110 ft. long, 30 ft. high, 45 ft. long at base, concrete abutments, forebay and headworks	22,000
Earth and wood dam, 35 ft. long, 10 ft. high, rubble-stone masonry abutments	1,000
Rock tunnel, cement-lined, 8 ft. by 8 ft., 300 ft. long, no supports	7,000
Two two-ply leather belts, 36-in. wide by 92 ft. long, at $865	1,730
300-kv.-a., a.c. generator, 2300 volts, 164 r.p.m., 60 cycles, direct-connected to water-wheel jack shaft, erected	5,400
500-kw. synchronous converter, 900 r.p.m., 600 volts, d.c., erected	5,850
3.5-kw. motor-generator battery-charging set, d.c. generator, 125 volts, direct connected to Fort Wayne, 5-hp., 220-volt induction motor, 1200 r.p.m. erected	486
15-kw. belted exciter, 675 r.p.m., 125 volts, erected	405
Two-ply leather belt for above, 4 in. wide, 30 ft. long	20
Three 500-kv.-a. water-cooled transformers, 44,000 to 2,300 volts, single-phase, 60 cycles, erected on wooden platform, complete with piping	6,000
Three 250-kv.-a. oil-insulated, self-cooled transformers, 2300 to 425 volts, single-phase, 60 cycles, erected on concrete foundation outdoors	3,220
Three 5-kw. oil-insulated, self-cooled transformers, 2300/110/220 volts, single-phase	225
23-kv.-a. automatic potential regulator, 2300 volts, 60 cycles, single-phase, erected	896
43.5 kw. constant-current tub transformer, 6.6 secondary amp., erected	985
Marble panel for above with 4-amp. stab switches, and one 100-amp., three-pole, 2300-volt oil switch, erected	105
5-ton traveling crane, 25-ft. span, hand-operated, erected	1,250
Two 1000-kv.-a. transformers, 44,000/13,000/2,300 volts, single-phase, 60 cycles, self-cooled, erected	8,860
Three oil circuit-breakers, type, 300-amp., 45,000 volts, three-pole, solenoid-operated, complete with relays, remote-control included in tower-house switchboard, erected on pipe framework, supported on concrete foundation	4,695
Four current transformers, 60/120 amp., ratio 12/24:1, 45,000 volts, erected	880
Twenty-seven disconnecting switches, 300 amp., 45,000 volts, outdoor type, insulator base, erected on pipe frame	864
Three sectionalizing disconnecting switches, 300 amp., 45,000 volts, line type with horn-gap break, erected	138
One outdoor-type, three-phase, 45,000-volt lightning arrester with horn gaps, erected	170
7½-in. wire-mesh fence on pole stubs, 10 ft. by 8 in. top, painted, 300 linear ft., erected	135
Three 750-hp. Pelton-Francis turbines, 22-in. double discharge, 120-ft. head, horizontal type, spiral casing, 600 r.p.m., with steel draft tubes, erected	14,850
One 75-hp. Pelton-Francis exciter turbine, 14-in. single discharge, 1000 r.p.m. horizontal casing, steel draft tube, erected	910
Two oil-pressure governors, erected	2,430
One oil-pressure governor, with motor control	1,900
Steel surge tank 100 ft. high, 6½ ft. diameter, enclosed in double 2-in. plank casing with 4-in. air space	3,750
Erected, concrete foundation	270
Steel penstock, 6-ft. diameter, 900 ft. long, on rock foundation, earth-covered	33,170
Steel receiver and connections, 70 ft. long	1,140
Motor-operated floodgate, d.c. motor, 19.35 amp., 115 volts, 900 r.p.m., operating 48-in. Chapman valve through bevel gear and pinion, with control panel, erected	1,305
2-ft. drainage gate valve, for penstock, erected	225
Wooden gates, 4 ft. by 4 ft., wood stems, lever, hand-operated (each)	75
Foreboy headgate valve, 7-ft. diameter, hand-operated, erected	450
Three 550-kv.-a. generators, 11,000 volts, three-phase, 60 cycles, direct-connected, 600 r.p.m., installed	18,975
Two 40-kw., 125-volt exciters, 1000 r.p.m.	1,260
One four-cell aluminum lightning arrester, 44,000 volts, erected	1,500
Six hand-operated oil switches, 300 amp., 11,000 volts, three-phase, enclosed in brick cells	1,500
14,000 linear ft. wood stave pipe, 60-in. diameter	168,000
3,000 linear ft. steel pipe, 60-in. diameter	72,000
90-ft. stand. pipe, 14-in. diameter	9,000

DISTRIBUTION EQUIPMENT

	Each
Chestnut poles, 35 ft. by 6 in. top	$6.50
Two-pin wooden cross-arms	.35
Four-pin wooden cross-arms	.45
Six-pin wooden cross-arms	.60
Eight-pin wooden cross-arms	.80
Ten-pin wooden cross-arms	1.15
Wood side brackets, painted	.05
Insulators, 2300 volts, double-petticoated	.08
Pole guys	4.00
No. 4 and No. 6 bare iron wire, per pound	.10
Copper wire, bare	.275
Installing services	2.50
Series sheet-lighting fixtures, 20-in. radial wave reflectors, 60 cp., 66 amp. incandescent lamps, installed	6.20
Novalux bracket fixtures, ¾-in. gooseneck, parabolic reflector, 60-hp. lamps, 6.6 amp., erected	4.50
Novalux pendant fixture, series type, 400-cp., type C, 15-amp. lamp, erected on center-span suspensions	25.50
Ditto, with 20-amp. type C lamps	27.00
Ditto, with 15-amp. type C lamps, erected on 10-ft. iron mast arms	20.10
Transformers, factory costs (2300—110—550v.):	
7.5 kw	63.36
10 kw	74.60
15 kw	106.92
20 kw	132.12
75 kw	320.40
100 kw	385.20
400 kw. (44,000-440 volts)	1,600.00
Delivery and erection ninety-seven transformers	2.50

Meters, factory prices:

	(110 Volts)	(220 Volts)
5 amp., single-phase	7.32	8.22
10 amp., single phase	8.55	9.45
15 amp., single-phase	9.45	10.58
20 amp., single-phase	10.70	11.70
25 amp., single-phase	11.70	12.83
30 amp., single-phase	12.50	.....
40 amp., single-phase	13.50	
50 amp., single-phase	15.98	17.33
75 amp., single-phase	18.45	19.18

5 amp., three-phase, 110 volts	$25.20
10 amp., three-phase, 110 volts	26.10
15 amp., three-phase, 110 volts	27.00
5 amp., three-phase, 220 volts	27.90
10 amp., three-phase, 220 volts	28.80
15 amp., three-phase, 220 volts	29.70
25 amp., three-phase, 220 volts	31.05
50 amp., three-phase, 220 volts	35.10
75 amp., three-phase, 220 volts	38.25
100 amp., three-phase, 220 volts	40.50
150 amp., three-phase, 220 volts	44.55
300 amp., three-phase, 220 volts	93.50
5 amp., three-phase, 440 volts	35.20
1500 amp., three-phase, 440 volts	66.20
200 amp., three-phase, 550 volts	53.55
One Graphic-power-factor meter with transformers	185.30
2-amp. excess indicators (factory)	6.00
10-amp. excess indicators (factory)	12.00

Economical Construction for Bus Compartments

Kansas City Substations Have 13,000-Volt Buses Consisting of Three-Conductor Cables in Fiber Ducts and Protected by a Wall of Concrete—4,400-Volt, Compartments Are Built of Pre-cast Concrete Units

THE new substations of the Kansas City (Mo.) Light & Power Company embody some striking designs in bus construction, and the building dimensions are thereby reduced to a minimum. These buildings, of reinforced concrete, are 46 ft. by 57 ft. (14 m. by 17 m.) and two stories high. One station has transformers installed to step down 12,000 kva. from 13,200 volts, three-phase, to 4,400/2,540 volts, three-phase, four-wire, for distribution on thirty-six single-phase lighting feeders and two three-phase power feeders. The other two substations have a transformer capacity of only 6000 kva. at present, but are designed for an ultimate capacity of 12,000 kva. The 13,200-volt buses are disposed in fiber conduit after the fashion of underground cable systems. Compartments for the 4,400-volt buses are made of concrete shapes which are cast beforehand and readily put together at the right time.

The 13,200-volt feeders connecting the different substations with the power station are not tied together at the substations, but each feeder delivers power to its own individual set of transformers at the substation. The capacity of the transformers is so chosen that when they are carrying their normal load the 400,000-circ.mil three-conductor cable supplying them is also carrying its safe normal load. In case of a cable failure the current-limiting reactors in the power-station end of the feeder limit the current flow to a value which will cause no undue disturbance as in other parts of the system, while a simple overload relay trips the cable free from the busbars.

Each substation has a 13,200-volt bus to which any set of transformers may be switched. These busbars are fed by a reserve cable which will be extended by a loop system to serve any one of several different substations.

These reserve 13,200-volt buses are hung from the basement ceiling underneath the 13,200-volt oil switches. Instead of the usual bar construction the buses are made of 400,000-circ.mil (200 sq.mm.) stranded insulated cable which loops up to the oil-switch terminals (see Fig. 2). The cables are run through fiber conduit. The ducts extending out of the bed are wrapped with rough jute rope free from oil or tar, after which they are covered with two coats of one-to-one cement mortar,

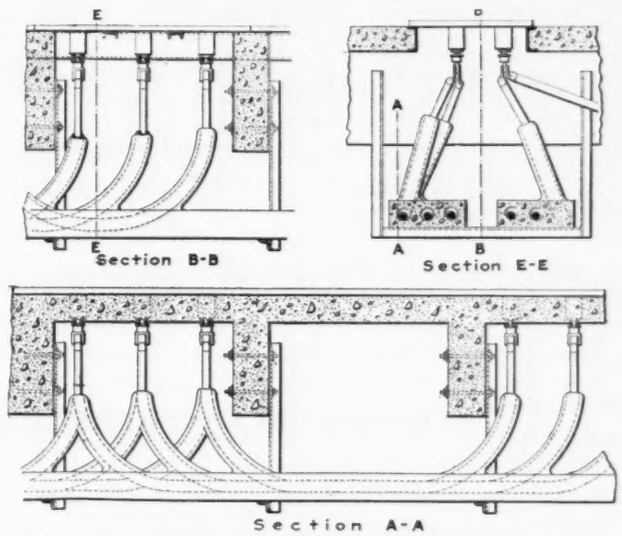


FIG. 2—13,200-VOLT BUSES IMBEDDED IN CONCRETE

This drawing shows the principle of looping in, which is in common use for wiring, applied to 13,200-volt bus construction in the new substations of Kansas City (Mo.). Stranded insulated cable of 400,000 circ.mil. (200 sq.mm.) is employed, run through 2.5-in. (65-mm.) fiber conduit. A concrete bed 19 in. (48 cm.) wide and 7 in. (18 cm.) thick is poured around each bus. The ducts extending out of this are wrapped with 0.25-in. (6-mm.) clean jute rope on 0.75-in. (20-mm.) centers. Then one-to-one cement mortar is applied in two coats around them to form smooth tubes with an outside diameter of 4.5 in. (11.5 cm.).

built up as shown in Fig. 2. The lugs are wrapped with varnished cambric to a thickness of 0.5 in. (12 mm.). The conduit is aligned in such manner that additional cables can be installed to make direct connections with the oil-switch studs.

In the 4,400-volt bus structure another new method

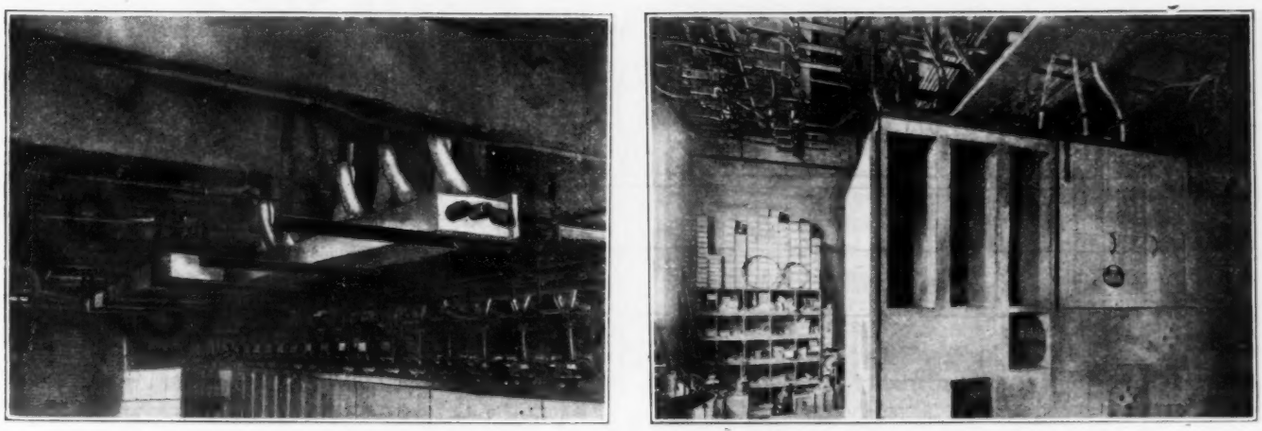
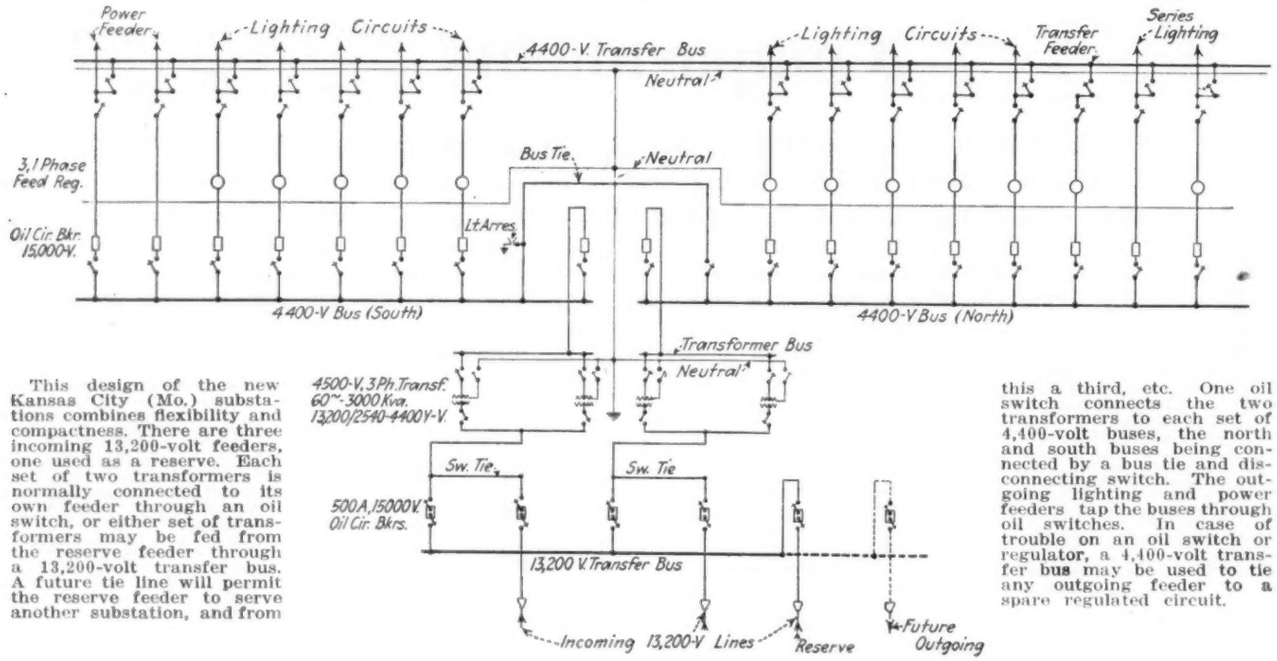


FIG. 1—GENERAL VIEW OF CABLE BUS AND PRE-CAST COMPARTMENTS IN PLACE



This design of the new Kansas City (Mo.) substations combines flexibility and compactness. There are three incoming 13,200-volt feeders, one used as a reserve. Each set of two transformers is normally connected to its own feeder through an oil switch, or either set of transformers may be fed from the reserve feeder through a 13,200-volt transfer bus. A future tie line will permit the reserve feeder to serve another substation, and from this a third, etc. One oil switch connects the two transformers to each set of 4,400-volt buses, the north and south buses being connected by a bus tie and disconnecting switch. The outgoing lighting and power feeders tap the buses through oil switches. In case of trouble on an oil switch or regulator, a 4,400-volt transfer bus may be used to tie any outgoing feeder to a spare regulated circuit.

FIG. 3—SUBSTATION TRANSFER BUSES TO INSURE CONTINUOUS SERVICE

Economical Construction for Bus Compartments

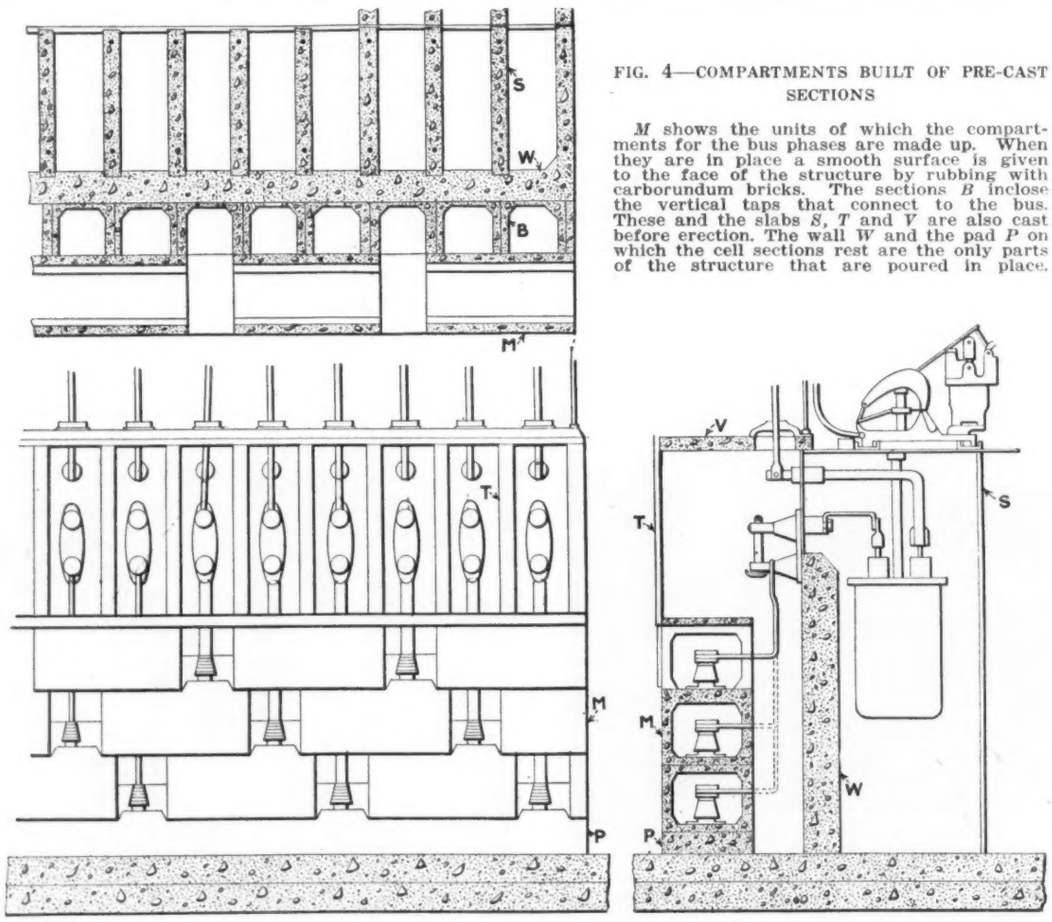


FIG. 4—COMPARTMENTS BUILT OF PRE-CAST SECTIONS

M shows the units of which the compartments for the bus phases are made up. When they are in place a smooth surface is given to the face of the structure by rubbing with carborundum bricks. The sections *B* inclose the vertical taps that connect to the bus. These and the slabs *S*, *T* and *V* are also cast before erection. The wall *W* and the pad *P* on which the cell sections rest are the only parts of the structure that are poured in place.

of construction was used. The bus compartments and the compartments for the connections leading from the bus to the disconnecting switches are built up of pre-cast concrete sections (*M* in Fig. 3) laid on the concrete pad (*P*) which is poured beforehand. At the points on the buses at which the connections are taken off openings are left between the concrete sections of the corresponding layer. When the entire structure is in place a smooth surface is given to the whole by rubbing with carborundum bricks. The sections for the vertical connection taps (*B*, in Fig. 3) are in the shape of a trough stood on end with the open side toward the bus. Also the vertical slabs between the connection taps and between the oil switches (*S* and *T*, Fig. 3) are cast before erection. The pad (*P*) and the wall (*W*) are the only parts of the structure that are poured in place. As the pre-cast units are set up before pouring the wall, very little construction for forms is required.

These blocks and slabs may be molded by fairly cheap labor while the building is being erected. When the building is ready it is quicker and cheaper to install the blocks and slabs than to set up forms and pour concrete or to make the compartments of brick.

Sargent & Lundy of Chicago, Ill., designed and supervised the construction of the substations and have applied for patents on the bus construction described herein.

Piece Work Reduces Cost of Motor Repairs

Records of Piece-Work Prices Paid in Steel Mill for Rewinding Direct-Current Armatures and for Making New Commutators—Segregated Costs Given for Completed Jobs

ONE of the Pennsylvania steel mills equipped throughout with direct-current equipment has reduced the man-hours required to rewind motor armatures to about one-third the time taken on day work. This has been accomplished by winding and taping the armature coils, insulating the core, placing the coils in the armature and connecting the coils to the commutator, on a piece-work basis. Some operations such as stripping the armature, taking off the commutator, repairing the commutator insulation, replacing a few bars, turning up the commutator, banding the armature, and testing are still done on day work. This is because the bending and stripping are done by helpers and the other operations mentioned are too uncertain to be placed on a piece-work basis. However, in making new commutators or refilling an old commutator shell with new mica and copper, the work is all done on a piece basis as is also the turning of new shafts and bearings.

The workmen naturally objected to the introduction of the piece-work system, especially as the first allowances were based on about two-thirds of the old day-work time. The men made so much money, however, on these allowances that the prices were further reduced until they are now based on about one-third of the day-work time schedule. The men have been treated fairly, however, and reference to Table II will show that most of the armature winders are able to make $1 per hour, and the helpers, where they are employed, earn 50 cents per hour at the piece-work rates.

Copper for new commutator bars is purchased in 6-ft. to 10-ft. (1.8 m. to 3 m.) lengths which have been rolled to the proper angle and thickness. The milling of commutator copper mentioned in Table I, therefore, includes cutting this copper into bars of the proper length, milling the ends of the bars to receive risers and cutting up risers from strip copper. Slotting bars means slotting the ends to receive the leads. This is done on some commutators which do not have risers. Making the commutator shell consist of turning up the cast-iron shell or bushing which holds the bars and mica together. On some armatures the shell is made from rolled round steel instead of from cast-iron but in either case it must be turned up complete with end rings having the proper bevel. The assembling of the commutator includes the assembling of the independent bars and mica segments, turning the *V* in the end of the

TABLE I—PIECE-WORK PRICES PAID FOR REWINDING 220-VOLT DIRECT CURRENT ARMATURES AND MAKING NEW COMMUTATORS IN 1919

Milling Commutator Copper Slotting Ends of	Crocker-Wheeler, 40-S-40-Hp.	Crocker-Wheeler, 15 D-S-15-Hp. DCC Wire	Crocker-Wheeler, 15 D-S-11-Hp. Heavy Asbestos Covered Wire Used	Crocker-Wheeler, 35 D-C-42-Hp.	Crocker-Wheeler, BW-S-15-Hp. Armature	Westinghouse, 5 K-S-11-Hp.	Westinghouse, 8-K-25-Hp.	Pawling & Harnischfeger, 10 x 6, 12-Hp.	Westinghouse, 1-K-2-Hp.	Pawling & Harnischfeger, 11 x 8, 16-Hp.	Pawling & Harnischfeger, 14 x 12, 30-Hp.
Milling commutator copper	$7.00	$6.00	$6.00	$11.50	$2.40	.....	.....	$1.60	.....	$1.60	$2.30
Slotting bars	.....	.....	.....	.....	1.24	.....	.....	1.65	.....	1.65	1.22
Making commutator shell	6.74	4.70	4.70	7.00	6.15	.....	.....	6.00	.....	6.00	.....
Assembling commutator	10.70	10.70	10.70	17.00	7.25	.....	.....	6.15	.....	6.15	6.74
Making coils	7.06	6.30	6.30	9.84	6.30	$4.92	$6.95	.....	$5.37	.....	.....
Winding armature { Winder	9.84	7.70	11.77	9.84	11.98	5.77	6.95	15.78	6.00	16.58	31.00
Winding armature { Helper	.....	.....	.....	.....	.....	.....	.....	7.89	.....	8.29	15.50
Turning new shaft and nut	.....	3.00	3.00	.....	2.68	1.92	.....	.....	.....	3.10	4.75
Turning bearings	.....	.....	.....	.....	.....	.44	.....	.....	.....	.74	.....

Table I gives the piece-work allowances for some of the different direct current armatures used in this particular plant. The time required to rewind armatures depends more upon the make and type than upon the horsepower. This is due to mechanical features which make some types more difficult to rewind than others. As a result it is sometimes necessary to readjust the piece-work allowance higher or lower, depending upon conditions.

TABLE II— COST OF REWINDING 220-VOLT D.C. ARMATURES AND OVERHAULING COMMUTATORS IN 1919

No.	Manufacturer	Frame No.	Type	Hp.	Rating	R.p.m.	Amps	Day Hr.	Work Amt.	Piece Work Hr.	Piece Work Amt.	Aux. Labor Hr.	Aux. Labor Amt.	Material	Overhead	Total Cost	Remarks
1	C-W	22MT	S	22	Int.	700	82	10½	$4.82	14½	$14.50	24	$4.38	$8.00	$11.85	$43.55	
2	C-W	201	CC	13	Const.	500	50	12	5.78	17	17.12	29	5.22	17.37	14.06	59.55	
3	C-W	20K	S	20	Int.	490	80	19½	9.75	17½	17.65	37	6.66	17.05	17.03	68.14	New shaft
4	C-W	40	S	40	Int.	750	152	19½	9.37	16½	16.90	36	6.48	21.21	16.37	70.33	Changed from ring to form wound
5	G-E	.....	CO 1807	15	Int.	600	60	15	5.79	11	11.07	25	4.68	11.82	10.77	44.13	
6	C-W	15D	S	15	Int.	800	59	15	7.79	13	12.81	28	5.04	14.60	12.82	53.06	Changed from ring to form wound
7	C-W	15D	S	11	Int.	580	42	9½	4.46	18½	18.07	27	4.99	27.11	13.76	68.39	Asbestos wire in armature
8	C-W	15D	S	15	Int.	800	60	6½	2.98	18½	14.00	24	4.75	15.28	10.71	47.72	
9	C-W	35D	CC	42	Int.	900	147	20	10.00	20	19.68	40	7.20	29.52	18.44	84.84	Mica undercut
10	C-W	5F	CC	5	.....	900	19	3½	1.48	11½	11.35	15	2.70	9.12	7.77	32.42	Commutator cleaned
11	C-W	BW	S	15	Int.	600	60	10½	5.23	17½	18.28	28	5.13	17.56	14.32	60.52	
12	WE&M	5K	S	11	Int.	700	46	5	2.49	12½	10.69	17	3.10	10.11	8.14	34.53	
13	WE&M	8	K	25	Int.	575	96	11½	5.04	14	13.90	24	4.46	10.65	11.70	45.75	
14	P&H	10x6	Crane	12	Int.	575	50	7	3.54	32	23.67	38	6.82	6.60	17.01	57.64	
15	WE&M	1	K	2	Int.	900	9	6	3.05	17½	11.37	17	3.06	3.56	8.74	29.78	
16	P&H	11x8	Crane	16	Int.	550	65	9½	4.32	33½	24.87	43½	8.65	10.65	18.92	67.41	
17	P&H	14x12	Crane	30	Int.	500	115	8½	4.27	32	31.00	72½	14.45	21.06	32.61	118.89	
										32	*15.50						

* Helper.

commutator, and assembling all on the shell ready to be placed on the armature shaft.

Armature coils are wound on a form at the winder's bench and not on a machine. The piece-work operations of making coils includes winding, stretching, dipping in varnish, drying in oven, taping the coils and tinning the leads. The armature winding operation for which the piece-price was set consists of cutting out core insulation, placing it in position, placing the coils in their proper places, connecting up the leads to the commutator, and soldering them in position. The armature tester working at a day rate then tests the finished armature. If any trouble develops the armature winder must do his work over again without any extra pay. This system has resulted in careful work and experience has shown that armatures rewound on a piece-work basis give just as satisfactory service as when they were repaired on day-work.

The actual cost of rewinding a number of different armatures is shown in Table II. The labor is divided up into piece-work, day-work and auxiliary. The work done under the two first headings has already been described. The auxiliary labor includes the time of store-room attendants, sweepers, clerks, etc. This class of labor averages from 17 cents to 20 cents per hour, for all the work done on any particular job. The overhead expense is taken as 50 per cent of all the electric repair shop labor, charged to the job.

Use of Radio by Transmission Companies

Employed by Georgia Railway & Power Company to Transmit Information from Dispatching Headquarters to Surrounding Stations as Well as to Construction-Department Trucks in the Field

By G. A. ILER

Superintendent operation, tests and repairs, Georgia Railway & Power Co.

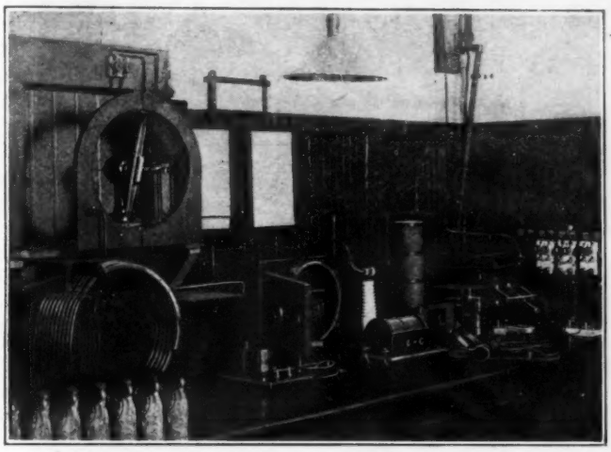
AS THE number of plants interconnected into one system grows and the load on the system enlarges it becomes increasingly important to maintain reliable communication between different parts of the system. This problem sometimes becomes difficult when communication is held by wire if there is a sleet or wind storm that breaks the conductors. In an attempt to avoid these interruptions the Georgia Railway & Power Company, Atlanta, began the use of radio-telegraph signals in 1914 for transmitting information from dispatching headquarters to the surrounding stations. While this work had not progressed very far when the World War started, five 1-kw. wireless stations had been placed in service and two 5-kw. stations were ready to begin service at the time when the United States government prohibited all wireless activities excepting that of the army and navy.

One of the most interesting applications of radio communication to the central-station field was the equipment of construction-department trucks with radio-receiving antennæ and other communication apparatus so that instructions might be received by the construction crew while they were still in the field at a considerable distance from wire communication. For this purpose, however, it was found that the radio-telegraph was not very satisfactory, but the experiments with radio-telephone were so satisfactory that the company is going to adopt that method of communication for instructing construction crews in the field in the near future.

During the use of radio apparatus there were several instances of where this method of communication was invaluable in handling an emergency. One time telephone communication to one of the large dams was interrupted, and there was no way of controlling the amount of water to be released from the large reservoir. If it had not been for the radio-telegraph a large amount of water would have been wasted. At another time a 1-kw. radio station was dismantled and carried over 100 miles to another station, erected, and communication established with headquarters inside of 24 hours. This experiment indicated what could be done in case wire communication should be interrupted by storms, etc., at some future time.

The company has also found that by having radio stations in several plants it is able to detect the approach of electrical storms a long time in advance, and in this way plants can be prepared to utilize water from heavy rains before the water spills over the dams, and they can also have their equipment in readiness to handle sudden loads caused by darkening of the skies.

It is also quite feasible to use wireless telegraph equipment in connection with a special detector to operate sectionalizing switches and disconnecting switches that may be located many miles away from an attendant. One way to utilize radio for this purpose would be to have automatic relays installed at each switching point that will respond to certain code signals the same as apparatus used by John Hays Hammond, Jr., in the wireless control of torpedoes. One of the greatest drawbacks in handling high-tension switches with radio con-



MAIN WIRELESS PLANT AT ATLANTA WHICH CAN REACH ALL OTHER STATIONS IN THE MOUNTAINS

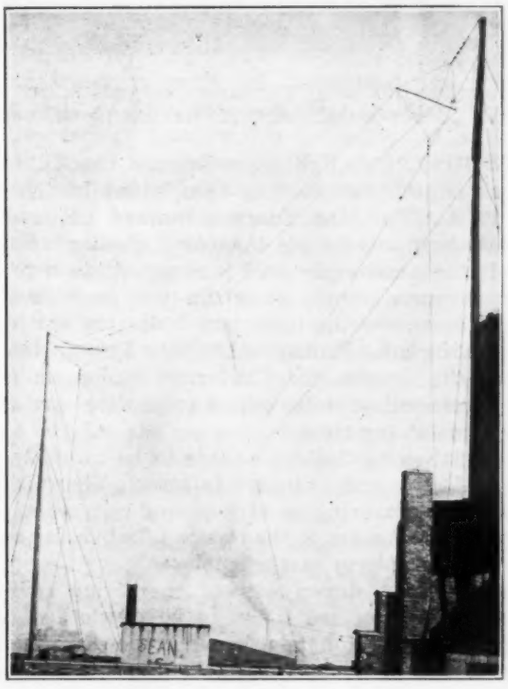
trol has been to construct a relay sensitive enough to be operated by a wirelsss detector, and also to construct a detector sufficiently sensitive to stay in tune all the time and operate this relay. However, due to the developments during the war, even these problems seem quite possible of solution. Unfortunately, however, the radio manufacturers are not aware that such apparatus is needed for these particular purposes.

The type of apparatus used by the Georgia Railway & Power Co. included a 1-kw. Clapp-Eastman sending outfit which was "loose-coupled" and employed a rotary spark gap, with a fairly high-pitched tone, and producing a wave length of about 200 meters. This outfit gave a sending range of 100 miles (160 km.) in any kind of weather. The receiving outfit included a DeForest automatic detector in connection with a one-or two-step amplifier, as occasion required. Owing to the high-pitched tone of the sending apparatus and the use of amplifiers, signals could be heard very distinctly despite static disturbances which usually manifest themselves as a very low-pitch cracking noise of considerable volume. When static was so bad that signals could not be read sufficiently accurate, a code of signals was adopted among the operators so that the necessary switching information could be given through very simple radio signals. All signals that were sent out giving switching instructions had to be repeated and an O. K. received by the sender to prevent errors.

Most of the apparatus was used in mountainous country, where radio apparatus is particularly at a disadvantage. One of the difficulties which was anticipated was that the near high-tension lines would affect the signals; however, no such effect was observed when the aerial was erected at right angles to the transmission line. Where more than one transmission line enters the power house the aerial should bisect the angle formed by the two lines to prevent any high-tension transmission interference. At some of the stations radio communication was maintained successfully within 50 ft. (15 m.) of 110,000-volt transmission lines carrying 60,000-kw. indicated load.

Since the war the Allies have withdrawn censorship on the apparatus used in France for radio telephones, so that it is possible that central stations will be able to solve many of the problems which this company encountered before the war. For instance, the different governments have perfected a radio-telephone equipment which is all that could be desired, having any range that would ever be needed by high-tension transmission companies, either with portable or permanent sets. It is obtainable in portable or permanent sets, the portable sets being very light in weight, quickly erected, and adapted to be carried on motor trucks. This outfit would enable a construction crew to keep in touch with load dispatcher's headquarters. However, as there is no way for the load dispatcher to call a truck station of this type, it would be necessary for the truck driver to listen for the load dispatcher at predetermined fixed intervals. In this way the dispatching office would not have to call the truck driver to gain his attention.

To instruct radio operators, classes were formed at several of the power houses where they could study the equipment in actual service under the leadership of a trained radio operator. This method, coupled with the enthusiasm that usually goes with any radio work, soon produced quite a number of fairly good radio operators.



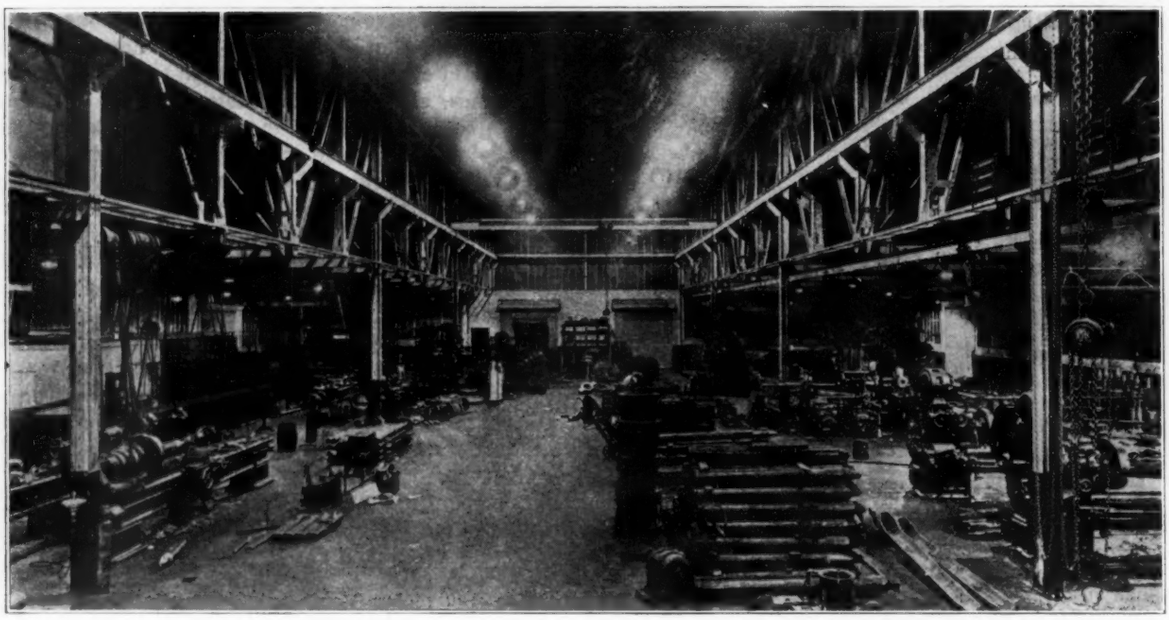
AERIAL CONSTRUCTION ON TOP OF THE REPAIR SHOP

Having been trained in power plants under operating conditions, these men were much more valuable than if they had been merely instructed in radio equipment and operation to the exclusion of station operation. During the training the men were required to keep log books showing all communications sent and received, the amount of load carried, water-gage reading, weather conditions, etc. Quite an amount of competition developed between the operators, each one striving to receive messages the fastest.

Industrial Lighting Codes

In Force in Six States Now—Fairly Uniform in Essential Features—Need of Glare Limits That Will Improve Diffusion in the Same Manner as Intensities Have Helped Production—Outlook Encouraging

By G. H. STICKNEY
Illuminating Engineer Edison Lamp Works



THE DISTRIBUTION OF ILLUMINATION IN THIS PLANT CONFORMS WITH THE SPECIFICATIONS OF STATE CODES NOW IN EXISTENCE BUT A GREATER INTENSITY COULD BE USED WITH BENEFICIAL RESULTS FROM INCREASED PRODUCTION

INDUSTRIAL lighting codes are now in force in six states, two having been added to the list in 1919. Thus the progress toward nationalization has been more rapid than most similar movements, and if the usual experience is repeated, we may expect a much more rapid spread in the next few years, especially among the important industrial states. The list now includes Pennsylvania, New Jersey, New York, Wisconsin, Oregon and California. Adoption in Ohio and several other states where committees are at work may come at any time.

Legislation of this type needs to be carefully drawn to be effective and to insure fairness. There is always a danger of favoring or of imposing unnecessary hardship on one or more of the classes affected, for example, either the employer or the employee.

In legislation drawn without enginering advice fundamental factors are liable to be overlooked or misunderstood. Fortunately for all concerned, the leadership in this movement was taken by the Illuminating Engineering Society, and the best available knowledge of the art was applied in a patriotic and disinterested way. It has, therefore, been possible to avoid these pitfalls.

The effectiveness of the codes was clearly indicated in the papers recently presented by the representatives of the several state industrial commissions at the Chicago convention of that society. In no state was there reported any real opposition on the part of industrial or labor interests, while, on the other hand, instances were cited where manufacturers had expressed to the commissions' engineers their appreciation of the knowledge imparted concerning the economic value of good lighting.

In fact, the commissions seemed to have no difficulty in convincing manufacturers that their own interests required considerably higher intensities of lighting than the safety standards specified in the codes. Even in those states where the inspection forces are not adequate to give individual attention to plants throughout the state, marked improvements in lighting have been observed, which apparently have resulted from the educational influence of the codes and other commission activities. In this connection it must be remembered that the purpose and authority of the codes is limited to insuring safety. Therefore the rules specify only what is necessary to prevent eye strain and to enable one to see objects well enough to avoid accidents. It is not possible at the present time to require in such regulations the higher standards of good practice, which lead to better manufacturing economy and larger production.

One of the hopeful features of the lighting code progress is the fact that in essential points a uniformity has so far been maintained by different states. An ultimate uniformity should be the goal sought. What is good lighting in Pennsylvania is good in New York, and there should be little or no variation in the regulations.

The codes do not pretend to be in a final state. Changes and improvements may be expected as we have more experience in applying them, as we acquire more knowledge of the factors of good lighting, and, still further, as conditions change.

Probably the first need will be a more definite specifi-

cation as to glare limits. At present much has to be left to individual judgment. An instrument is needed which will measure degree of glare and do for diffusion what the foot-candle meter is doing for intensity. It is obviously impossible to give numerical glare limits at the present time.

While the intensity steps seem to be about right, there has been considerable discussion as to the best method of presenting them—whether long definite lists of processes or short general lists shall be used. The more definite list is certainly to be preferred, if practicable, and is especially desired by inspectors. An ideal condition would be to have a table listing each process of manufacture with intensity and glare-limit values. The difficulty of providing a dictionary of intensity values is that the same nominal process is carried on with widely varying degrees of fineness, so that in one shop a considerably higher intensity is necessary for eye conservation than could be fairly demanded of another carrying on the same process but on a coarser scale.

It is hoped that education toward the higher "productive" intensities will generally solve the problem, without recourse to a long and complicated list. Such a list would tend to overemphasize the intensity factor as compared to diffusion and, further, would imply an accuracy to the limits which the variations mentioned do not seem to warrant.

On the whole, the code situation seems to be very encouraging. Codes are being adopted in other states as rapidly as could be expected. They are bettering working conditions. Instead of imposing a hardship on manufacturers, they are proving beneficial in educating them to better operating economy. There is a good prospect of improving the regulations which are made in the future, rendering them even more definite and effective.

Electrical Manufacturing Plant Capacity

Large Volume of Business from Domestic as Well as Foreign Buyers Makes Increased Facilities Necessary for Companies That Cannot Otherwise Meet the Demands Upon Them

Measuring the different influences for and against plant expansion under present conditions, A. W. Berresford, president of the Associated Manufacturers of Electrical Supplies and vice-president and general manager of the Cutler-Hammer Manufacturing Company, gives his conclusions. He believes that extension—well considered and conservative in each instance—is warranted.

MANY electrical manufacturing companies are finding that expansion of their plants and organization is necessary if they are to meet with reasonable promptness, the unprecedented demands for apparatus and supplies. Several years of little or no expansion because of war conditions explain in part why expansion is necessary now; and to this is added the tremendous public and industrial demand which followed the armistice and still shows no signs of abating.

Not all of the manufacturers in every line of electrical apparatus and supplies feel that the construction of new plant is required now. In some branches it is estimated that the release of the companies from the necessity of providing for war essentials will enable them to meet all commercial demands for their products. Nevertheless, the growth of business is receiving careful consideration in all quarters. So well able is the manufacturing part of the industry to finance requirements that it is believed confidently that plant expansion will take place wherever it is desirable to meet enlarging markets for products.

That action has been taken by large as well as many of the smaller electrical manufacturers to increase their physical plant facilities and their personnel correspondingly is an indication that these companies calculate on still greater requirements from consumers. They find their support for this conclusion in the orders from every section of the country and the reports from sales representatives that delivery dates pushed months into the future do not dismay buyers. The business is there and it is based primarily on country-wide activity in nearly all industries and on the extraordinary prosperity of the public. It receives additional impetus from the unusual demand from many foreign countries.

Some of the conditions which are accepted as justifying the construction of more plant facilities are the great demand for supplies for the large amount of new building which is going on throughout the country. The scarcity of dwellings and office buildings and the extensive factory construction in various other industries which are maintaining activity on the intensified plane of the times are evidences of a continuing market.

In planning to construct additional building capacity the electrical manufacturers are of course confronted by the abnormal present level of costs. Costs which are excessive as compared with pre-war figures have to be paid not only for labor and materials entering into the buildings but also for the manufacturing machinery which is a part of the completed plant. The high level of these costs would naturally lead them to hesitate if it were not for the pressure for their products which in some cases is leading to delays in the delivery of goods substantially beyond the usual time. One manufacturer gave as a particular reason for expansion the fact that deliveries had fallen behind to such a degree that it was felt to be inadvisable to ask customers to accept the inevitable long delays.

Careful consideration has been given to the subject of plant expansion by A. W. Berresford, president of the Associated Manufacturers of Electrical Supplies and vice-president and general manager of the Cutler-Hammer Manufacturing Company. As the demand for increased production in the field of electrical supplies is especially active the members of this association are among the manufacturers who are interested in the matter of larger manufacturing facilities. At the request of the ELECTRICAL WORLD Mr. Berresford discussed the subject.

"Decision as to increase in manufacturing facilities under present conditions and the extent to which such increase is warranted, if at all," said Mr. Berresford, "should be based on what proportion of the present

admittedly abnormal demand is legitimate, and, further, to what extent reasonable expectation would indicate that such increased facilities may be continuously employed."

As no method of obtaining accurate data on either of the above conditions is available, Mr. Berresford said that the judgment of the individuals responsible in each specific instance must be the deciding factor. He thinks that probably no error of importance would result from assuming a present demand 100 per cent in excess of the pre-war needs. A considerable portion of this is due to the restriction of construction during war times, and, while legitimate, it cannot be considered permanent.

"If it be assumed that during three years of the period between 1916 and 1919 inclusive there was a probable reduction in ordinary applications of say 20 per cent," Mr. Berresford added, "and if an effort is now being made to make up this entire deficiency, this would account for approximately 60 per cent increase; and if we assume a normal annual increase rate equivalent to that prevailing in general business—approximately 6 per cent—this would add approximately 20 per cent. For want of a better basis, therefore, it seems fair to divide the assumed 100 per cent increase somewhat as follows:

	Per Cent
Normal expectable increase	20
Accumulation increase	60
Abnormal increase	20

"Assuming facilities operating at essentially full capacity at the beginning of the period, there would be indicated an eminently safe extension of 20 per cent, and if there be added sufficient in addition to care for say one-third of the accumulated demand, a further addition of 20 per cent would be indicated, making a total of 40 per cent over pre-war facilities.

"There would appear to be a reasonable expectancy of continuous operation of such increased facilities, in that, on the basis of providing for only one-third of the accumulated demand, three years would be required to supply this demand, and during those years the 6 per cent factor of general business increase would again be operative, making a total of 40 per cent addition to the pre-war standard of production, which is the amount proposed for the increase of facilities."

While Mr. Berresford recognized that all of the above is admittedly founded on assumption and speculation, he felt that the assumptions and results do not appear unwarranted.

"The adverse elements," he continued, "are obviously the high comparative cost of addition to both plant and equipment and the difficulty of predicting the period of continuance of active business under conditions which contain such a multitude of uncertain elements. It would seem, however, to be unduly conservative, and certainly contrary to business and human instinct, to make no effort to profit reasonably by the present conditions and in the end the general rate of increase should absorb the increased facilities. I believe therefore that extension—well considered and conservative in each instance—is warranted.

"In the case of the Cutler-Hammer Manufacturing Company such an increase, approximately 30 per cent, is in process. The company, however, has been fortunate in securing properties already constructed and adjacent to those it now operates, thus eliminating, in part at least, the cost of present-day building operations."

Some important additions to plant capacity are planned by various manufacturing companies in the industry.

The General Electric Company is adding units to existing groups of buildings in different localities. It has also expanded in another striking way through the acquisition of several of the smaller manufacturing companies or of a financial interest therein. Instances of these purchases are the newly acquired interest in the Trumbull Electric Manufacturing Company and the Radio Corporation of America. These cases are, of course, more than purely physical expansions of plant. They involve an implied addition in the personal elements of manufacturing plant. They mean an increase in the working personnel and in the management forces. So far as the plants in which an interest is thus acquired are located at other places than those of the existing establishments, they also serve to decentralize the labor forces. This latter factor is an advantage in itself, for it provides for the company concerned additional communities from which labor may be attracted.

The Westinghouse Electrical & Manufacturing Company is in the position of having provided for a large increase in its manufacturing facilities at Essington, Pa., during the war. Establishment of works at that point was designed to lead in time to a development equal to that at East Pittsburgh. The plans of the company underwent a change as a result of the entrance of this country into the war. With the signing of the armistice it was thought that the release of the facilities needed in war work would provide the necessary plant capacity for commercial needs. For instance, the plant at Springfield, Mass., which was acquired in connection with the Russian rifle order, is now used in the manufacture of small motors. It is understood that additional plant is to be constructed to meet the requirements of an expanding demand.

Among the developments designed to increase the manufacturing facilities is a plant under construction by the Western Electric Company, Inc., at Norfolk, Va. Submarine cable will be made at this plant.

From the foregoing it is clear that certain increases in manufacturing plant are made necessary by the very active conditions in the industry.

There is one factor which possibly may affect the situation and that is the labor one. It has undoubtedly affected it already. When labor is less efficient in production, more physical plant is required per unit of labor to attain the desired output. Conversely, the more efficient the labor, the less plant is needed.

Labor has been notoriously inefficient and a result is seen in the higher level of costs in nearly all commodities. Efforts to encourage greater production by labor are being made throughout all industries and to the extent that workers co-operate in these the strain on manufacturing physical resources will be relieved.

Books Received

APPLIED SCIENCE FOR METAL WORKERS. By W. H. Dooley. New York: The Roland Press Company. 480 pages, 207 illustrations.

APPLIED SCIENCE FOR WOOD WORKERS. By W. H. Dooley. New York: The Roland Press Company. 458 pages, 206 illustrations.

Readers' Views and Comments

Forces Acting on Disconnecting Switches

To the Editor of the ELECTRICAL WORLD:

SIR: With reference to Julian Loebenstein's article in the ELECTRICAL WORLD for March 17, 1917, page 504, on the forces tending to open switches on short circuit, I have had occasion to study the subject under discussion and feel constrained to write and point out the very serious error contained therein. This error might easily cause designers to go astray in calculating for the design of switchgear.

(1) In the formula given in the article, viz.,

$$T = \frac{kI^2A}{3}\left(\log \frac{AL}{B\,(L + \sqrt{A^2 + L^2})} + \frac{L}{\sqrt{A^2 + L^2}}\right)$$

the logarithm is obviously to the base e, whereas Mr. Loebenstein takes it to be to the base 10. This, of course, materially affects the tables and curves.

(2) The method of arriving at the formula is by means of Ampère's "action at a distance" method, one which has been the source of contention amongst mathematicians for a considerable time. It would be useless for me to enlarge on these discussions, and I will merely quote from Jean's "Electricity and Magnetism," page 443:

" . . . so that we are almost compelled to give up all attempts at explaining the action between the circuits by theories of action at a distance. We accordingly attempt to construct a theory on the hypothesis that the forces result from the transmission of stresses by the medium. This, in turn, compels us to assume that the energy of the system of currents resides in the medium."

Following out this line of argument, I have tackled the problem by considering the self-induction of a closed rectangle which, using the symbols contained in the above-mentioned article, is:

$$4\left(L \log_h \frac{2AL}{M\,(L + \sqrt{A^2 + L^2})} + A \log_h \frac{2AL}{M\,(A + \sqrt{A^2 + L^2})} + 2\,(\sqrt{A^2 + L^2} - A - L)\right)^*$$

where A and L are the sides of the rectangle and M is the G. M. D. of section of the conductor. For a circular conductor $M = 0.7788 \times$ diameter, "$\log_h$" is the logarithm to the base e).

The rate of change of induction due to the slight opening of the switch is proportional to the torque on the blade, and we finally arrive at the result that

$$\text{Torque} = KI^2A\left(\log_h \frac{2AL}{0.8\,B\,(L + \sqrt{A^2 + L^2})} + \frac{\sqrt{A^2 + L^2}}{L} - 1\right)$$

If I is in amperes, A and L in inches and B is the semi-blade width in inches, and the torque is in pounds feet, $K = 0.187 \times 10^{-8}$.

*See Winkleman's "Handbuch d. Physik. Elek. II," p. 595.

If we consider that A is the blade length and L the length of the leading-in busbars, this formula is only strictly true when L is infinite, because we are considering a closed rectangle, whereas in practice only three sides exist. If, however, the arithmetical values are worked out, it will be found that for $A = 12$ the torque is practically constant for values of L over 12 in.

As a matter of interest the torque in pounds-feet is given in the table below for values of L between 12 and infinity:

$I = 20{,}000$ amp., $A = 12$, $K = 0.1817 \times 10 - 8$.

$B = 1$ in.	$B = 0.5$ in.	$B = .1$ in.	$B = 0.01$ in.
25	32	45	67

It will be seen that these values are very much higher than those given by Mr. Loebenstein, and it is contended that his figures are far too low. He compares his results with those obtained practically from General Electric Company switches, but assumes:

(a) That the blade is 0.1 in. Now B is semi-blade *width*, not *thickness*, and as the switch blade is usually at least 1 in. wide, B should be taken as at least 0.5 in. and not 0.1 in. Presumably Mr. Lobenstein has confused the terms width and thickness.

(b) That the maximum value of the current should be taken and not the root mean square. This surely is incorrect, as in all alternating-current calculations (vide dynamometers, etc.) values for the torque are based on the R. M. S. values.

A good check on the above figures is found in the case of the General Electric 1,200-amp. switch referred to by Mr. Loebenstein. It is fitted with a clip for short-circuit currents of 20,000 amp., and in their case the mechanical torque to open the switch was found to be 32.5 lb.-ft. (compare figure of 32 above).

In the case of the 600-amp. switch 14,000 amp. was specified. This in the formula above gives 15.4 lb.-ft. (compare with mechanical torque of 16.25 lb.-ft. required to actually open the switch).

L. B. W. JOLLEY.

Research Laboratories of General Electric Company, London, Eng.

Ordering Correct Size of Furnace Electrodes

To the Editor of the ELECTRICAL WORLD:

SIR: In calculating the proper size of electrodes for electric furnaces account should be taken of many different conditions under which the electrodes work in addition to the amount of current carried. An electrode may be theoretically large enough for the current rating and still a larger size might be used more economically. In ordering electrodes from the manufacturer, in addition to the current rating, the transformer rating, the secondary voltage and the approximate power factor should be given. The character of the lining, whether it is acid or basic, should be stated. The kind of material charged and the ultimate product of the furnace should be included. A furnace operating on light scrap is much easier on elctrodes than one handling heavy scrap. Another condition which must not be omitted is the position of the electrodes. When they operate in a horizontal position provision must be made for special joints which are not needed with vertical electrodes. Only with information on all these points can the electrode manufacturer accurately determine the best electrode for the particular installation.

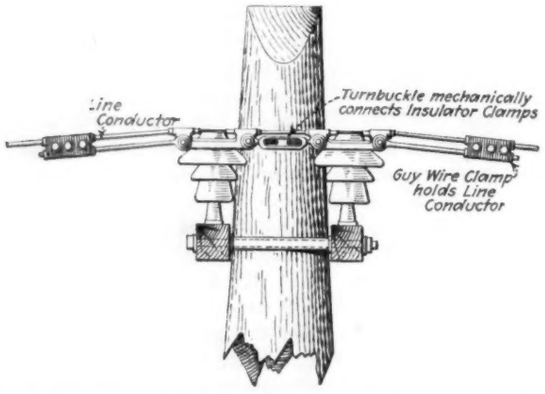
Acheson Graphite Company, Niagara Falls, N. Y. A. B. OATMAN, Sales Engineer.

Station and Operating Practice

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

Preventing Line Failures at Railroad Crossings

IN THE report of the joint committee on specifications for electric light power supply and trolley lines crossing steam and electric railroads which was presented before the American Electric Railway Association, the accompanying drawing was given as an illustration of a typical wood-pole insulated construction for crossings. The object of this particular design is to arrange the tie wires, clamps and other fastenings so



COMPLETE MECHANICAL CONNECTION INSURES AGAINST FAILURE OF CONDUCTOR

that the conductors will be held under maximum load regardless of shattered insulators or wires burned or broken at the insulator. This is accomplished by means of a turnbuckle, two guy clamps and two short pieces of guy wire. The turnbuckle holds the two insulator clamps and can be adjusted to various distances between cross-arms. To the other side of the insulator clamps are attached two short guy wires, which are connected to the conductor by means of a guy-wire clamp. In this way a complete mechanical connection is obtained for a distance of 12 in. (30 cm.) on each side of the cross-arms.

Effect of Engine Speed on Generator Operation

THE voltage at which direct-current generators are designed to operate and the speed proper for that voltage are always shown on the nameplate of the machine. Sometimes machines must be operated at higher or lower voltage, and if the difference in voltage is considerable (over 6 per cent) adjustment by means of the field regulator may not give good operation. This trouble was encountered in a 250-volt generator designed for 150-r.p.m. where operation at 220 volts was desired. The shunt-field current was 7 amp. and the shunt field had 900 turns per pole, or 6,300 ampere turns. The series field had eight turns per pole, and the full-load current of 600 amp. gave 4,800 series ampere turns per pole. The series ampere turns (4,800) at full load were therefore 43 per cent of the total of 11,100 per pole when operated at full speed and voltage.

As 6,300 ampere turns (shunt alone) was sufficient to give 250 volts at no load, it was too much for 220 volts, and adjustment by field rheostat to about 5¼ amp., or 4,700 amp. turns per pole, was necessary to give the desired no-load voltage. This required nearly all the resistance that the field regulator contained.

This shunt field being weak, the addition of 4,800 ampere turns per pole due to full-load current in the series, which now supplied 51 per cent of the total field, brought the full-load voltage to more than desired, and the series current had to be partly diverted through a shunt.

It would have been much easier and better to adjust the engine governor to give a speed of 132 r.p.m., leaving the electrical adjustments as they were designed to be, and this was afterward done.

There is another seriously bad effect due to weak shunt field. When a sudden application of load occurs, such as that encountered in starting an elevator, the quick change in armature current causes a drop in voltage for a very short time until the series field has time to respond to the increased current. If the shunt field is relatively weak, and the drop of voltage over the series field due to the "kick" of load is a high percentage of the total, the effect of a sudden load is more noticeable and may be seen in lamps supplied from the bus.

This cannot be overcome by adjusting the series field shunt, and if such conditions are found the only satisfactory remedy is to operate the machine at the right speed for the busbar voltage.

Difficulties in Operating Motor-Generator Set Inverted

WHEN a motor-generator set in an industrial plant was operated so as to deliver alternating-current energy considerable trouble was met because of the machine increasing in speed as load was applied. Ordinarily this machine operated with the alternating-current unit as a motor and the direct-current and delivering energy in parallel with a plant consisting of 250-volt direct-current generators driven by turbines. Some of these machines are three-wire, and the motor-generator set had a split-series field. In operating the alternating-current unit as a motor and the direct-current end as the generator no difficulty was met, but when operating inverted it was impossible to keep the machine on the line. The series field was cut out and the motor run as interpole shunt motor. With the field rheostats all cut off the natural speed of the motor is 670 r.p.m. Because the machine was to be connected to a 60-cycle line it was necessary to raise the motor speed to 720 r.p.m. by weakening the field. This weakening of the field made the shunt field quite

weak, and the interpole had a compound effect, opposing the shunt field and increasing the motor speed as the load increased. The interpole strength was adjusted for correct commutation. It was not advisable to decrease it as sparking would probably follow. In order to prevent the set from taking more than its share of the load, it was, of course, necessary to make its speed variation with load the same as that of machines with which the alternating-current end was to be paralleled.

It was suggested that one way to make this set operate correctly was to use a Tirrill regulator and a separate exciter for the generator in order to keep the voltage constant. This would have failed because the division of load between alternators in parallel depends upon the driving force applied to their shafts and not to any considerable extent upon the field current in the alternating-current rotors.

The remedy in this case was obtained by changing connections so that the series field of the direct-current end was in circuit when the unit was operated inverted. The series field held the speed down as the load came on. Reversing switches were connected in each half of the split series field so that the polarity of the series field was correct and yet could be easily changed back for normal operation. The regulation was checked by trial on a water rheostat so that the alternating-current generator could be operated at full load without being in parallel with the other machines.

Recording Status of Insulation

FOR keeping in constant touch with the condition of the insulation on the 20,000-volt transmission tie line which connects the Silver Lake steam plant of the Pittsfield (Mass.) Electric Company with the system of the Southern Berkshire Power & Electric Company at Lee,

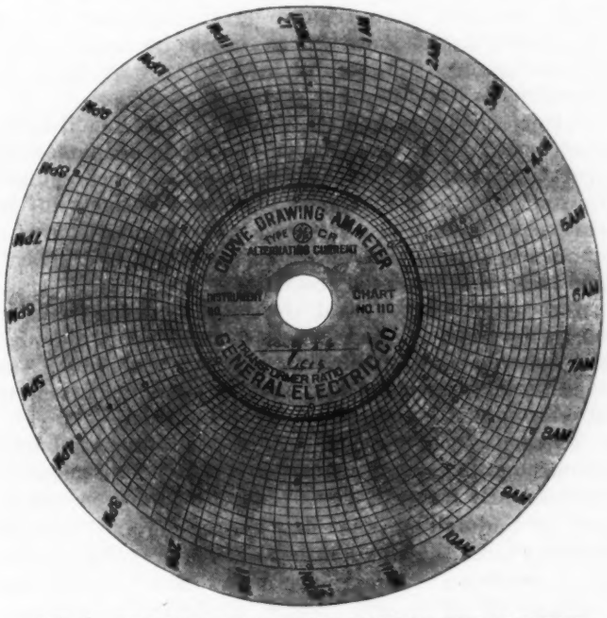


FIG. 1—SAMPLE OF THE CHART MADE BY THE AMMETER

Mass., a curve-drawing ammeter has been successfully utilized. Energy at Pittsfield is generated at 2,400 volts, two-phase. It is then raised to transmission pressure by T-connected transformers, and the neutral point of the latter is grounded through a current transformer to which a General Electric curve-drawing ammeter is connected. In case of a ground on the line, which causes unbalancing, the ammeter pen registers the disturbance as a cross-line on the chart. Under normal conditions a continuous circle is drawn by the pen on the chart, which thus can be used day after day until abnormal conditions arise.

In Fig. 1 it will be seen that an oil circuit-breaker opened at 9:15 a.m., owing to grounding, and that

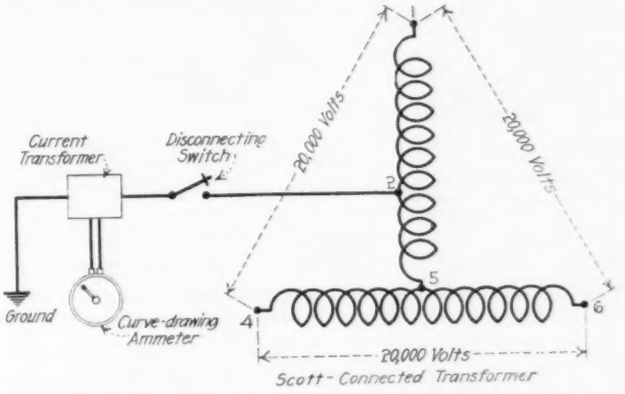


FIG. 2—METHOD OF CONNECTING CURVE-DRAWING AMMETER TO REGISTER LINE DISTURBANCES

another temporary disturbance occurred at 3 p.m. These records serve not only as operating history, but when swinging grounds or partial grounds occur, which might cause a shut-down if allowed to remain, the pressure of the continuous chart aids in calling attention to unusual conditions and has not infrequently enabled continuous service to be maintained. The information bearing upon this matter was furnished by G. E. Whittlesey, superintendent of construction, Pittsfield Electric Company.

Low Exciter Voltage Causes Control Trouble

THE importance of a reliable source of direct current for control must not be underestimated because serious trouble may result from its failure. This was illustrated recently in a power plant where several feeder switches are installed at some distance from the switchboard and the energy for the control bus is normally supplied by storage batteries. When any repair work is done on the batteries the switch in the figure is used to connect the control bus to an exciter bus rated at from 80 volts to 120 volts for normal load conditions. At one of these times the operator failed to raise the exciter voltage before switching over on the exciter bus, but intended to do so immediately by adding resistance from the generator field rheostats. Before he had an opportunity to do this a short circuit on one of the feeders operated the overload relay, which in turn energized the feeder circuit-breaker trip coil with a potential of about 85 volts. The switch, which never before had failed to open with 110 volts, now failed to open. The operator after finding out which feeder the short circuit was on tried to open the switch with the remote control pull button, but this could not be done because the relay kept the trip coil energized. The voltage regulator had raised the exciter voltage to 135 in an effort to keep the alternating-current bus voltage normal, but even this high voltage failed to open the

switch when the trip coil plunger could only push on the latch and was not able to strike a blow.

The operator could have opened the generator switches, thereby shutting down a section of the plant or the whole plant, to clear the short circuit, but this was not absolutely necessary. He could have opened the switch between the exciter and the control bus and have closed it again instantly. This procedure would strike the hammer blow on the feeder switch latch, since the relay contacts remain closed until the short circuit is isolated. It is advisable to be ready to open

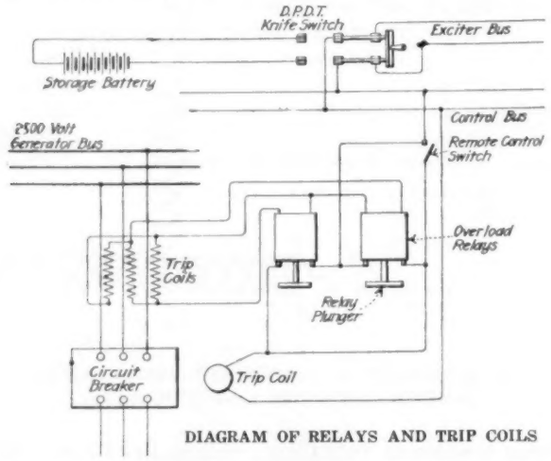


DIAGRAM OF RELAYS AND TRIP COILS

and close this control bus switch rapidly in any similar emergency, as a succession of these hammer blows will usually open a switch even if the control voltage is low.

It was stated that the operator intended to raise the exciter voltage by turning in resistance on his generator-field rheostats. This would not disturb the alternating-current voltage regulation as the voltage regulator would compensate for this. L. W. WYSS.

Iron Mountain, Mich.

Rules for Operating Remote-Control Switches

WHEN a station operator has learned to operate oil circuit breakers he usually does not study the matter further. Nevertheless, in order to insure correct operation of these switches they should be thoroughly understood. Some things that should be remembered are as follows: When synchronizing the remote-control switch handle should not be held in the closed position any longer than is necessary to close the switch, because there is a possibility that a loose connection or poor contact may prevent the switch from closing immediately; then, if the remote control switch handle is held in the closed position, the switch may close after the generators are out of synchronism. Moreover, if the control voltage were low and the handle held too long, the switch might not latch in the closed position. This might lead to serious results when synchronizing. If the control switch is held just long enough to close under normal conditions, it will open immediately in case it does not latch closed, thereby preventing trouble.

When opening a switch it is useless to hold the remote-control handle in the open position longer than about half a second, because the switch is usually unlatched by the "hammer blow" of the trip-coil plunger. If the switch does not open at the first hammer blow, it should be operated again.

Service Quickly Resumed After Substation Fire

THE speed with which the loads served by the East 105th Street substation of the Cleveland (Ohio) Illuminating Company were switched over onto other sources of supply after a disastrous fire starting at 4:30 p.m. Dec. 31 typifies the value of the company's flexible distribution system. Although the flames melted the lead sheaths on cables, ignited the insulation on the conductors, and spread to the 2,300-volt distribution switchboards and street-lighting panels, destroying control circuits, damaging minor apparatus, cracking panels, etc., almost all of the loads had been transferred to other stations by 11 p.m. the same night. The problem of clearing the substation from all outgoing and incoming circuits was particularly difficult because the dense smoke made it impossible for the operator to determine whether the control apparatus worked or not.

The trouble was caused when a transformer bank having both high-tension and low-tension oil switches in the open position was being transferred through knife selector switches from a dead to a live bus. Two of the selectors had been closed and the third was being closed when an arc started caused by a defective bushing in the bus side of the third phase of the high-tension switch. This broke down to the grounded frame of this pole and ignited the insulation on the lead-in conductors as well as the oil inside the switch tank of this phase, the flames spreading as mentioned above. The fact that the switch was a triple-pole, 11,000-volt oil switch with each pole in a separate pocket prevented other oil being ignited.

The location of the defective bushing was such that the bus had to be killed to clear trouble at this point. While the arc was severe, there was sufficient resistance in circuit to limit the current flowing over the individual transmission cables feeding this station to a value below that required to trip the switches at the generating end. These switches were tripped by the operator at the generating station, however, as soon as he received telephone notice of the trouble, and steps were taken to transfer the loads to other stations.

After the fire was extinguished it was found expedient to cut out all cables that had been racked under the operating room ceiling, and to save the time required for splicing, those undamaged portions in ducts in the station walls were also removed. The mechanisms of a number of oil switches were found damaged by the heat, and these were replaced from stock.

Instruments were tested, the majority being found in operating condition and correct in calibration, although they showed signs of being exposed to intense heat. The high-tension structure and station transformers were also tested and found to be in good condition.

As soon as cables could be installed and tested they were connected one at a time to the various distribution circuits. By the next day five circuits were operating, and by midnight of that day a total of eight general lighting circuits and six street-lighting circuits were in good condition. Twenty-five hours later service was restored to all circuits, which comprised twenty-nine lighting and power circuits, in addition to the railway substation's load and that of a large industrial plant fed from the 11,000-volt distribution cables.

H. W. WALLAU,
Electrical Engineer.

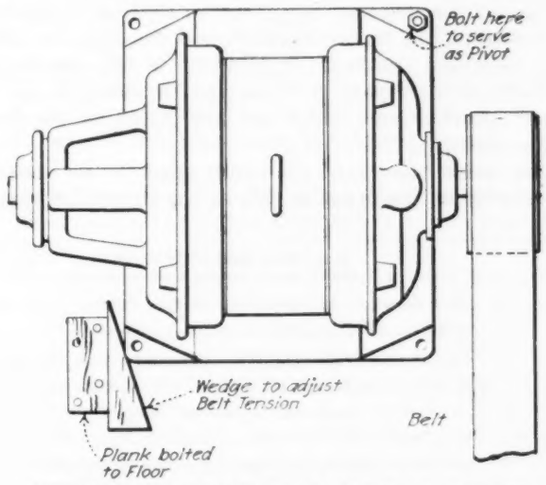
Cleveland (Ohio) Electric Illuminating Company.

Industrial Applications

The Economical Utilization of Electrical Energy in Mills and Factories, Together with Practical Details of Installation, Control, Testing and Repair of Equipment Required

Motor Installation for Temporary Drive Not Bolted to Floor

WHEN a motor driving a machine by means of a belt is to be installed for use over a short period of time, the method shown here has been used with good results. The adjustment of the motor in relation to the driven machine is very simple and can be accomplished in a short time. Only one corner of the motor base is bolted to the floor. This in itself saves considerable time in making the installation. Diagonally opposite the bolted corner, a plank is attached firmly to the floor. The wedge is then inserted between the plank and the motor base as shown, so that the motor position can be adjusted until the belt travels on the center of the pulley.



ONE BOLT AND WEDGE HOLDS MOTOR IN POSITION

Large Industrial Plant Maintenance Methods

BY ADHERING to the rule that long successful operation of motors and control apparatus is more economical from a production point of view than a low first cost, the Gillette Safety Razor Company has maintained almost continuous operation for a number of years. Spare parts are kept in stock to provide for any emergency. When new motors are received, if no extra bearings are on hand these are immediately ordered. To have in stock bearings to fit every motor in service is thought by the company to be the cheapest insurance for continuous operation.

Equal in importance with this practice is that of careful and regular inspection, which will contribute greatly to keeping the motors on the line. In the Gillette plant the night electrician cleans, removes and replenishes oil wells and tests each motor with a gage at least once every six months. Motors are inspected as to the proper amount of oil each Monday by the foreman of the electrical department, who is responsible for their external cleanliness.

For quick or emergency connections 100-amp. bulldog clamps are available with 6 ft. (1.8 m.) of flexible auto cord connecting one pair. Three pairs are on hand so that a defective switch or compensator can be shunted if necessary.

The cost methods in this plant are as follows: Repair work is charged on the workmen's daily time card, each department having a designated number. The letter R following this number indicates repairs. If new apparatus is installed, the letter P is indicative. Stock is kept in the electrical department storeroom, and its cost is recorded on a card index file and charged to the job when finished. A large job has a special ticket, and the workmen charge their time on their cards to this number. When the job is completed a list of stock is tabulated and charged off, and the card is sent to the office marked "finished," with the head of the department's signature.

I. H. GASKIN,
Electrical Engineer.
Gillette Safety Razor Company,
South Boston, Mass.

Home-Made Tools for Electrical Repair Shop

AT THE repair shop of the American Electric Service & Maintenance Company, Springfield, Mass., the set of home-made tools illustrated herewith is used to facilitate rapid work. These devices are as follows: (1) Paper cutter, (2) wedge driver, (3) wedge driver, (4) tapered slot or lamination straightener, (5) tape reel, (6) wedge driver and (7) tape hook.

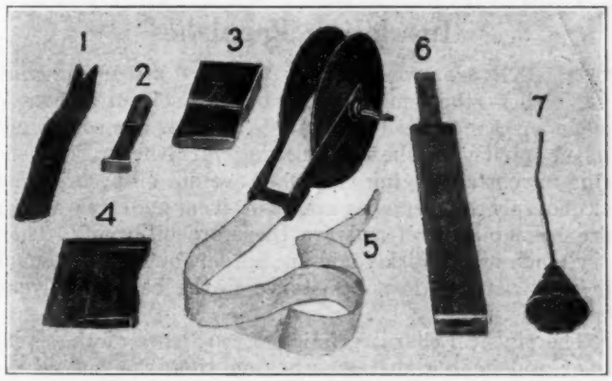


FIG. 1—TOOLS USED IN MOTOR REPAIR SHOP

The paper cutter (1) is 6 in. long, $\frac{3}{8}$ in. wide and $\frac{1}{32}$ in. thick (15 cm. x 15 cm. x 0.8 mm.), with a slight offset in its central portion to facilitate prying and a V-shaped slot at the end to enable protruding paper to be easily cut down to the slot level. The wedge drivers (2 and 3) are of convenient shape for work within the stator frames of motors and gen-

erators, and the tapered slot or lamination straightener (4) is a handy tool 4 in. long, 2 in. wide and ⅜ in. in maximum thickness (10 cm. x 5 cm. x 9 mm.), with tapered surface from right to left, making it more convenient to smooth out slot interiors applying the coils. The tape reel (5) provides an easy means of keeping tape out of the way when working around the bench, the brass circular sides being 3 in. (7.5 cm.) in diameter and provided with a U-shaped clamp with rods at the upper end throuugh which the tape is fed. A wing screw enables the movement of the reel to be adjusted for the correct amount of friction required to pull out the tape. With this reel only enough tape to handle the immediate requirements of the job is fed forward, and there is no rolling about of loose tape as from an ordinary unwinding reel.

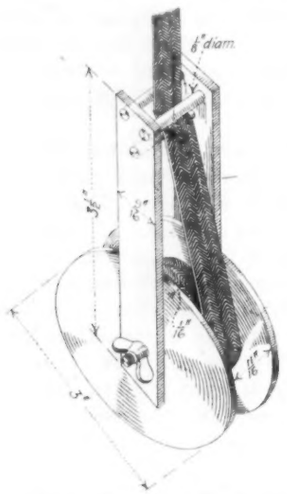


FIG. 2—DETAILS OF EFFICIENT TAPING REEL

The wedge driver (6) is essentially an extension hammer which fits into a slot and which can b forced forward from without in such a way as to bring effective working pressure upon tightly em bedded wedges in order to remove them or to force them into final position. It consists of a ½-in. x ⅛-in. (1.3-cm. x 3-mm.) steel tongue running in a steel holder bar 9 in. (23 cm.) long. The tongue is driven forward in proper alignment by placing a driver bar in the tool and hammering from the outer end. The tape hook (7) is 5 in. (13 cm.) long with an additianal 1¼-in. (3.1-cm.) bend at the end and is convenient in handling such material.

Characteristics and Uses of Air-Drying Insulating Varnishes

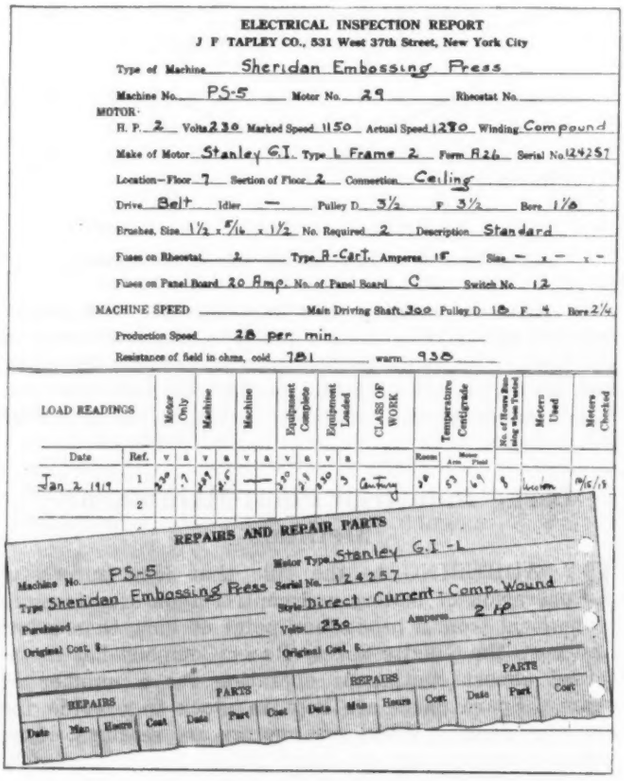
THERE are two different types of air-drying varnishes—those made with a benzine solvent and those made with an alcohol solvent. The latter are commonly called spirit varnishes or finishing varnishes. The benzine solvent air-drying varnishes are not oil-proof. The alcohol solvent varnishes are made from materials which are insoluble in oil and are therefore oil-proof. They dry much more quickly and are harder, but are not equal in elasticity and heat resistance to the benzine solvent varnishes.

The physical characteristics of varnishes of the same color and having the same baking time are not necessarily the same. Electrical apparatus is subject to many different conditions of usage, and it is necessary that the varnish be strongest in those particular characteristics which will be most needed. For example, a street-railway motor is exposed to the action of rain and snow on steep grades, and during periods of heavy traffic it is overloaded with resultant heating. A varnish to be successful on such a motor must be extremely water-resisting and must possess the longest possible life under heat. An automobile-starting motor armature which operates at a speed of from 10,000 r.p.m. to 12,000 r.p.m. requires a varnish possessing extreme mechanical strength and binding and cementing properties. Other characteristics, while important, are subordinate to these. In choosing a varnish for any particular work the usage to which the equipment will be subjected should be taken into careful consideration.

Electrical Inspection Report for Direct-Driven Machines

IN ORDER to maintain inspection and maintenance records of motors in the book-manufacturing plant of J. F. Tapley, New York City, the accompanying forms have been adopted to record the testing and repairs of all of the motors in the shop. The results of the periodic tests which are made on the motor are tabulated so that inefficient operation can be instantly recognized by a comparison of the data obtained in different tests. Load readings of current and voltage are taken in the test, together with the temperature conditions of the motors. Accuracy in the test is assured by recording the meter numbers and the date on which they were last checked. In addition to the comparison of tests of the motor, a check can be obtained by the motor specifications, which are also listed on the front of the sheet.

The entire expense of the motor since it was installed is recorded on the opposite side of the inspection report.



ELECTRICAL INSPECTION REPORT
J F TAPLEY CO., 531 West 37th Street, New York City

Type of Machine Sheridan Embossing Press
Machine No. PS-5 Motor No. 29 Rheostat No.
MOTOR
H. P. 2 Volts 230 Marked Speed 1150 Actual Speed 1280 Winding Compound
Make of Motor Stanley G.I. Type L Frame 2 Form A26 Serial No. 124257
Location—Floor 7 Section of Floor 2 Connection Ceiling
Drive Belt Idler — Pulley D. 3½ F 3½ Bore 1⅛
Brushes, Size 1½ x 5/16 x 1½ No. Required 2 Description Standard
Fuses on Rheostat 2 Type A-Cart. Amperes 15 Size — x — x —
Fuses on Panel Board 20 Amp. No. of Panel Board C Switch No. 12
MACHINE SPEED Main Driving Shaft 300 Pulley D 18 F 4 Bore 2¼
Production Speed 28 per min.
Resistance of field in ohms, cold 781 warm 930

LOAD READINGS		Motor Only		Machine		Machine		Equipment Complete		Equipment Loaded		CLASS OF WORK	Temperature Centigrade			No. of Hours Running when Tested	Meters Used	Meters Checked
Date	Ref.	V	A	V	A	V	A	V	A	V	A		Room	Motor Arm	Motor Front			
Jan 2, 1919	1	230	1	228	2.6	—	—	230	3.1	230	5	Cutting	28	63	69	8	Weston	9/12/18
	2																	

REPAIRS AND REPAIR PARTS
Machine No. PS-5 Motor Type Stanley G.I.-L
Type Sheridan Embossing Press Serial No. 124257
Purchased Style Direct-Current-Comp. Wound
Original Cost, $ Volts 230 Amperes 2 HP
Original Cost, $

REPAIRS				PARTS			REPAIRS				PARTS		
Date	Man	Hours	Cost	Date	Part	Cost	Date	Man	Hours	Cost	Date	Part	Cost

FRONT AND BACK SIDE OF ELECTRICAL INSPECTION AND MAINTENANCE REPORT

Here the original cost of the driven machine as well as the driven motor.

As repairs are made on the motor their cost is listed under this cost as shown. The recording of data of the kind, while it entails considerable work, is invaluable in that it allows the determination of the motor maintenance necessary and in that it gives a good idea of

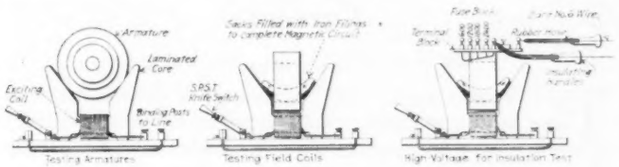
whether or not the motor is operating correctly. Many times this information will show that the machine is incorrectly motored, and the result of a correction made in a few such instances will pay for the entire cost of the testing and clerical work.

R. E. PETERS,
Works Engineer.

New York, N. Y.

Armatures and Field Coils Tested by Transformer Action

MANY motors and generators, after being repaired or rewound, are oftentimes put back into service still at fault, with a consequent loss of time and money, all through the lack of suitable testing apparatus. There are nearly as many different kinds of testing devices as there are repair shops, some being better than others.



DEVICE USED FOR THREE DIFFERENT PURPOSES

The apparatus described below has given excellent service for a number of years, although it is simple and inexpensive.

A laminated core is built to a thickness of about 4 in., (10 cm.) and is mounted on a board with a switch and screw binding post to connect to the line. If it is to be used on 220 volts, 60 cycles, 180 turns of No. 10 D.C.C. wire should be used on the exciting coil; if voltage is 110, ninety turns of No. 7 or two No. 10 wires in parallel should be used. As it is impossible to design a core which will fit all armatures, two strong canvas sacks filled with iron filings are used between the armature and the core.

In order to test armature for grounds, a fairly high alternating-current voltage should be used, depending on the class of apparatus repaired. For a breakdown voltage up to 2,400 volts a coil is wound with 4000 turns of No. 21 D.C.C. wire, taps being brought out at 1,000, 1,500, 2,000, and 3,000 turns, which will give approximately 600; 1,000, 1,200, 1,800 and 2,400 volts respectively. The core after being wound should be dipped in a good insulating varnish, baked and mounted on a strong, light board with the various binding posts. It should then be calibrated with a voltmeter and posts with their respective voltages plainly marked. The test leads should be well insulated and brought to handles.

During testing the armature is placed as shown, the binding posts are connected to the line, and the switch is closed. Short circuits are located by the heat they develop, and also by the attraction of the tin explorer, which is used to explore around the armature. It will be noticed that when two commutator bars are bridged by the explorer a spark is produced. When an open circuit is encountered the spark is greatly increased, while a short circuit is indicated by the absence of spark. The region of sparking on commutators varies as to the type of winding of armature under test.

To test field coils, place them as shown with the sacks filled with filings to complete the magnetic circuit. If there is a short circuit in the coil, it will be indicated by heat or smoke or by placing a light strip of tin on the upper inside of coil under test. If the coil is short-circuited the strip will be attracted.

To make a voltage breakdown test on an armature commutator or complete motor, place the high-voltage coil in the same position as when testing a field coil. The terminals with the voltage desired are connected to the test leads and used as illustrated.

Care should be taken when testing a field coil with a large number of turns, or when using the high-voltage coil, not to let the bare leads come in contact with any exposed part of the body. Such an accident might have fatal results.

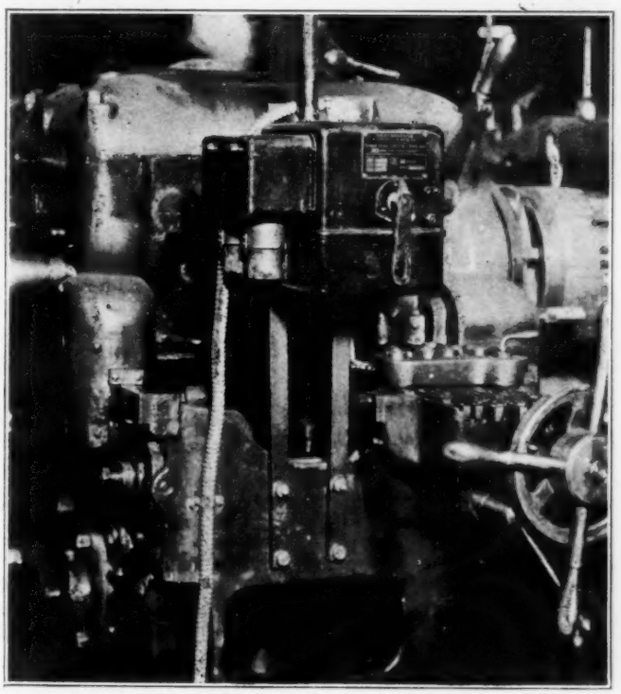
ANTHONY J. MORRONI.

Washington, D. C.

Solving a Difficult Problem in Switch Mounting

IN ELECTRIFYING a Jones & Lamson two-spindle, heavy-duty turret lathe the mounting of the starting switch presented a serious problem in a Massachusetts factory on account of the movable head with which this machine tool was equipped. It was desirable to have this switch within easy reach of the operator without placing it in his way. As shown in the accompanying photograph, a simple and efficient scheme for doing this was adopted. The switch, a Westinghouse No. 815, was attached to the main frame of the lathe by two 1-in. x $\frac{7}{16}$-in. (2.5-cm. x 11-mm) strap irons fastened to the frame with four $\frac{5}{16}$-in. (8-mm.) bolts.

The three-phase leads serving the motor in this case



CONVENIENTLY LOCATED LATHE CONTROL WITH CIRCUITS IN RIGID OR FLEXIBLE ARMORED CONDUIT

were brought down to the switch from overhead in a straight run of vertical $\frac{3}{4}$-in. (18-mm.) conduit, and the feed to the motor, three No. 10 wires, was carried from the switch in armored flexible conduit. A careful survey of the tool showed no place so satisfactory as that illustrated for the mounting of the switch, taking everything into account.

Central Station Service

A Department Devoted to Commercial Policy and Management Topics, Including Methods of Increasing the Use of Electric Light, Power and Heat

Effect of Attractive Retail Store on Public Good Will

A LARGE sum of money has been spent by the Milwaukee Electric Railway & Light Company to remodel the room in which its customers transact most of their business with the company. This was done in recognition by the company of a duty which it believed rested upon it to establish a proper standard for electrical merchandising and to place such commodious and convenient quarters at the disposal of its patrons that their business could be handled in the most expeditious and efficient manner. The results which have been obtained not only by the sale of merchandise but also in the creation of favorable public sentiment toward the company have amply justified the expense.

The room, which is approximately 115 ft. long x 40 ft. wide x 18 ft. high (35 m. x 12 m. x 5.5 m.), had previously been used as a salesroom. However, all the old fixtures have been removed and the room was entirely refurnished and redecorated. The walls have been paneled with quarter-sawed oak to a height of 9 ft. (2.7 m.) Handsome showcases with looking-glass backs and interior illumination have been installed. Other fixtures have also been put in to harmonize and to give the whole an imposing appearance.

The convenience of customers and salespeople has been carefully provided for in the arrangement and by the installation of elevators and pneumatic tubes. Ample space has been provided for the sale and demonstration of all electrical household appliances. Arrangements have been made for the sale and exchange of lamps, for taking service applications, and for taking in the money at a special cashier's cage placed in an easily accessible position.

NEW APPLIANCE SALESROOM IN MILWAUKEE

This view shows one end of the customers' room recently remodeled by the Milwaukee (Wis.) Electric Railway & Light Company. The lamp counter is behind and to the right of the cashier's cage which is shown in the center of the photograph. The service application counter is at the opposite end of the room.

Costs of Changing to Alternating Current

BY E. J. TRACY, JR., ST. LOUIS

THE cost in June, 1919, of changing over a railroad-car building plant which generated its own direct-current power to operate on central-station alternating-current power is given in the table herewith. The figures are carefully estimated, costs based upon data collected for the purpose from installations that were changed in five different sections of the country. The connected motor load in the car works is 3,500 hp. and the average load 1,800 kw.

The new arrangement will embrace a building for the alternating-current substation with concrete foundations, brick walls, fireproof windows and doors and concrete roof. The over-all measurements are 20-ft. by 25 ft. by 30 ft. (6 m. by 7.5 m. by 9 m.). The roof will support three 13,200/440-volt, 750-kva., single-phase, 60-cycle transformers. Two sets of motor-generators, of

200 kw. and 100 kw. respectively, will be installed for lighting and for operating hoists, cranes, small drills and variable-speed motors by direct current. New electrically driven compressors will replace the steam compressors. Most of the steam hammers can be changed readily for operation by air. There will be ten tablet boards for power with about thirty circuits each and

ESTIMATED COST IN CHANGE FROM DIRECT TO ALTERNATING CURRENT

Building	$4,000	
Three 13,000-volt, 750 kva. transformers	9 000	
One indoor 13,000-volt T.P.S.T. oil switch	500	
Indoor choke coils, insulators, busbar and disconnecting switches	800	
One bank of electrolytic arresters	1,000	
One 200-kw. and one 100 kw. motor-generator	12,000	
Five-panel switchboard	1,500	
Instruments	400	
Miscellaneous and labor at 60 cents per hour	3,700	
Total cost of substation		$32,900
Alternating current motors, 3500 hp. at $20 per hp		70,000
Changing and wiring 180 motors, at $75 each—average size about 20 hp		13,400
New feeders, six to eight buildings, 500 ft. to 1,000 ft		10,000
4,000-cu.ft. air compressor and 75-hp. motor		10,500
Ten tablet boards		8,000
Miscellaneous items, 10 per cent		14,500
Total		$159,300
Salvage from direct-current motors at $5 per hp		$17,500
Salvage from old feeders		2,000
Total salvage		$19,500
Total net cost		$139,800
Interest and depreciation, 1 per cent per month		1,400
Cost per hp. of connected load		40

the present lighting tablet can be used. New feeders from 500 ft. to 1,000 ft. (150 m. to 300 m.) long to six or eight buildings will be run.

These figures give a total estimated net cost of $139,800, or about $40 per horsepower of connected load after deducting the salvage.

Winter Revenue for Curbside Outlets

AT LONDON, Ontario, the Public Utilities Commission has installed at the curbside on principal streets several outlets such as shown in the accompanying illustration. At these outlets connections can be made for electric heaters by automobile owners to prevent freezing of radiators and water-circulating systems when cars are parked along the curb. E. V. Buchanan, general manager at London, Ont., has proposed the installation of such outlets throughout the downtow section, each outlet to be protected by a locked cabinet and keys rented to automobile owners at $5 per year. A record will be kept of the owners' car numbers so that inspectors passing along the streets can detect any user of the service who has not made the required deposit.

AUTOMOBILE ELECTRIC HEATER CONNECTED TO CURBSIDE OUTLET TO PREVENT FREEZING OF RADIATORS

The Electrical Co-operative Campaign in California

Review of Results Obtained in Two Years and Plans for 1920 in Which Central Stations and All Trade Groups Take a Part

THE California electrical co-operative campaign, instituted in December, 1917, has in little more than two years built up a strong organization with an efficient staff constantly employed in directing its activities. The purpose of the campaign, to unite the efforts of the various branches of the industry, has been successfully attained, for a state-wide propaganda is now being conducted to educate the general public in affairs electrical, with particular emphasis on the utilization of electric household appliances. That those interested in the maintenance of the campaign consider its achievements worthy of added encouragement is shown by the fact that the tentative budget for 1920 provides for expenditures of about $27,000, whereas the 1918 budget was for $8,700. This expansion indicates true confidence in the value of the campaign's continuance. It should be noted that the annual budget gives no complete idea of the money expended in furthering this movement, for members of the advisory committee, who meet monthly in different parts of the state, serve without pay and meet their own traveling and other expenses. The funds to pay for co-operative advertising, not handled directly through campaign headquarters, no doubt aggregates half a million dollars yearly.

From the outset the central stations have taken a leading part in the activities of this organization. They have contributed liberally to the expenses of the campaign, and it is estimated that of the total funds available in 1920 approximately one-third will come from this source. Of the total amount spent for advertising in the "electrical sections" possibly one-fourth is the outlay of the central stations, with practically all the remainder coming from contractor-dealers.

Upon the advisory committee, which is the directorate of the campaign, the power companies are accorded representation of three members out of the ten, the others representing the electrical manufacturers, jobbers, contractors and dealers. The chairman of the committee is Lee H. Newbert, head of the commercial department of the Pacific Gas & Electric Company. A. W. Childs, superintendent of sales for the Southern California Edison Company, and A. Emory Wishon, assistant general manager San Joaquin Light & Power Company, are other central-station members of this committee.

Above all, the object of the campaign and the thought that has animated it from the beginning is expressed in its slogan, "Better service to the public." The improvement in service sought was not merely in kind but in scope. It was felt that it was not enough that the central stations should take steps to improve, wherever possible, their service to the public; it was deemed essential that there should be general improvement in every branch of the industry.

Especially was it considered desirable that the contractor-dealers should undertake aggressively the work that had in part been assumed by the central station—the sale and installation of labor-saving devices. The contractor-dealer was looked upon as the logical salesman of the industry, the vital point of contact with the public. With proper encouragement, declared the campaign leaders, he could proceed with confidence to en-

large the scope of his business, reach out for new opportunities, improve the appearance of his place of business and introduce better merchandising and accounting methods.

Accordingly the campaign stands squarely behind the sales activities of the contractor-dealer. The confidence thus inspired in the contractor-dealer, who realizes now fully that the central stations and other interests are backing him in his efforts, does not fail to arouse a more friendly feeling everywhere in the industry. There is also manifested a reciprocal desire on his part to understand and interpret to his customers the central-station problems and viewpoint. In this way several rough points, long existent, in the relations of the contractor-dealers and the central stations are gradually being smoothed out.

The results to date have been gratifying. In 1919, out of a total of 400 dealers, 212 either had new stores or completely remodeled their stores. The number of absolutely new establishments was seventy-nine; the new locations counted seventy, and sixty-three dealers made very extensive alterations in their places of business. Many who had before no show windows to display their goods have made the necessary changes, and attractive window displays are no longer the exception.

In addition to attaining increased store sales, a considerable number of dealers have, at the urging of the campaign committee, placed solicitors in the field to stimulate sales still further. In December, 1919, there were 167 solicitors actively engaged, all sent out by dealers, whereas a year ago it is estimated that there were perhaps twenty-five in the entire state. Two years ago there were practically no solicitors employed by dealers, though the central stations had a few. The employment of many new outside solicitors by dealers seems to point very definitely to profitable business returns from their efforts. Electrical contractors have also contributed to the general forward movement by urging upon builders the inclusion in their wiring plans of additional outlets, especially baseboard outlets, to permit the more ready use of electrical appliances.

Co-operative Newspaper Advertising

Another feature of the campaign is co-operative newspaper advertising. A full page each week in many of the metropolitan papers is now devoted to contractor-dealer advertisements, accompanied by a central-station advertisement. In many cases there have been entire "electrical sections," of great advantage to the advertisers. The central-station advertisement is usually the keystone of the arch—holding often a preferred position on the page. The doctrine of electrification of the household is conveyed with full adequacy by the contractor-dealers, and the central stations address the public on topics of broad policy. This co-operative advertising has not resulted in larger advertising appropriations by the power companies, but the contractor-dealers have increased their space manyfold.

Full-page advertisements by the electrical industry are not restricted to papers in the large cities. Many daily and weekly journals in the rural communities have fallen in line. Altogether, it is conservatively estimated that there will be 6,000 full pages of electrical advertising in newspapers of California in 1920. The campaign employs specially commissioned field agents to work up interest in the "section idea" in various parts of the state, but when they enter the territory of a power company to organize these sections they invariably consult the management of that company so that they may work in harmony with its well-established publicity policies.

Much prominence has of late been given by the press of the state to news items of interesting happenings in the electrical field, and trade journals of the industry have also freely devoted their space to wider publicity for the co-operative movement. A special press service for circulation among the editors of California is issued regularly under the direction of the publicity committee of the Pacific Coast Section, N. E. L. A., which works in conjunction with the campaign organization in this very important enterprise. I. W. Alexander, of the San Joaquin Light & Power Corporation, is chairman of this committee.

Newspapers Liberal with Space

As to the value of thus sending out news material, one eloquent fact is revealed. In newspapers where "electrical pages" have appeared the news space devoted to happenings of the industry reaches about 20 per cent of the advertising space utilized, whereas in other newspapers it amounts to only 5 per cent. Many newspapers have published editorials in which the friendly attitude predominates, and agitation for municipal ownership has virtually disappeared.

The sales results of the 1919 campaign activities are now being tabulated by a special committee of the organization, headed by D. E. Harris, vice-president and sales manager of the Pacific States Electric Company. The complete figures will unquestionably show a considerable gain in the sales of electrical household appliances over those of 1918. At the Christmas season, for instance, dealers reported increase in sales of from 25 per cent to 100 per cent over last year.

All this sales activity has, of course, indirectly benefited the central stations, as it has also benefited the jobber and the manufacturer. The public's interest, above all, has never been lost sight of, for it is well understood that only by a careful conservation of the rights of the public can the industry continue to grow and prosper. These rights of the public are superior electrical service from the central stations, high-quality merchandise at fair and uniform prices from the dealers, adequate wiring and first-class workmanship from the contractors, and, through these latter, prompt delivery on orders from the manufacturers and jobbers.

How Picture Post Cards Promote Good Will in San Joaquin Valley

THE post cards on sale on drug-store revolving racks usually reflect the community's pride in its objects of interest. A series of a dozen views of the San Joaquin Light & Power Corporation's property which have recently been made into post card form, are therefore an evidence of the good will with which the company is regarded through the San Joaquin Valley district which it serves. The psychological effect of this form of advertising is in all respects favorable. Not only do men and women become familiar with the extent and importance of the company's holdings, but in purchasing the cards they feel that they are buying pictures of one of the community's show places. On the address side of each card is a brief description supplementing the title printed on the face of the picture.

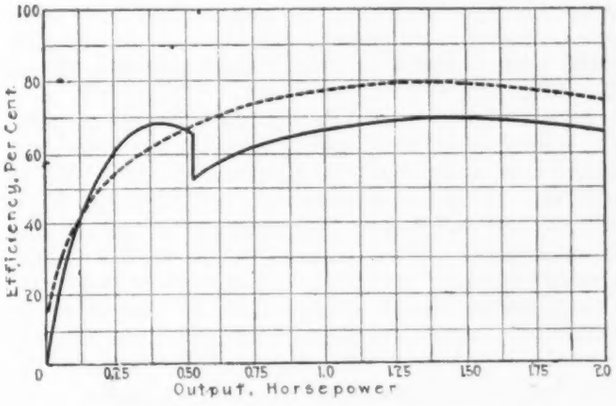
Digest of Electrical Literature

Including Brief Abstracts of and References to Important Articles Appearing in the Scientific and Engineering Press of the World

Generators, Motors and Transformers

Excitation of Alternatives with Salient Poles.—M. DE CONINCK.—Some time ago the author published (*Lumière Electrique*, 1915) a new diagram for the calculation of the necessary excitation ampere turns in a synchronous generator. The same theory now appears in a slightly modified and more complete form. Methods are outlined for determination of the equivalent ampere turns of the armature reactions and of the inductive drop due to apparent leakage inductance, which latter is shown to vary with the power factor. The scheme does not require a knowledge of the voltage curve for reactive load and is said to give more accurate results than the usual methods.—*Revue Générale d'Electricité*, Oct. 11, 1919.

Synchronized Induction Motor—F. KEITH D'ALTON.—In this paper it is shown how the rotor of an induction motor may be modified so that the machine will automatically synchronize itself and will show considerable stability in operating as a synchronous motor. Characteristic curves of a small squirrel-cage induction motor were first obtained and then the rotor was formed



SYNCHRONOUS OPERATION OF A SQUIRREL-CAGE INDUCTION MOTOR

The dotted lines indicate induction-motor characteristics

into one with salient poles by cutting four wide grooves in the rotor core. Efficiency curves of the motor operating as a synchronous motor and as an induction motor are shown in the illustration. It is noticeable that at about 0.512 hp. the motor pulls out of synchronism and operates as an induction motor with greater air gap. The power factor of the motor is necessarily lower with this increased air gap.—Toronto *Electrical News*, Oct. 15, 1919.

Lamps and Lighting

High-Power Electric Searchlamps in the War.—MARIUS GROSJEAN.—In the last two installments of this article a great number of illustrations are given, showing various types of large searchlamps, as used by the French army in the war. The arc lamps are either mounted on special trailer trucks, or on automobile chassis for portability, while the largest units of semi-stationary types are erected on small railway trucks, the motor-generators being built as independent units. Several systems for control at a distance of the direction of the beam of light are described and also some methods for ascertaining parallelism between a telescope and the axis of one or more searchlamps.—*Revue Générale d'Electricité*, Oct. 11 and 18, 1919.

Reflecting Power of Stellite and Lacquered Silver.—W. W. COBLENTZ.—The reflecting power of stellite varies somewhat in the visible spectrum, depending upon the homogeneity and upon the exact composition of the alloy. Measurement on lacquered-silver mirrors, made before and after exposure to ultra-violet light, shows that, owing to photochemical action in the lacquer, the silver is turned brown in color, thus reducing the reflecting power.—*Scientific Paper No. 342, U. S. Bureau of Standards*, Sept. 11, 1919.

General Lighting and Safety Orders.—The paper gives a digest of the general lighting safety orders issued by the Industrial Accident Commission of California. These became effective Dec. 1, 1919.—*Journal of Electricity*, Jan. 1, 1920.

Records of Lamp Service in a Large Park System.—C. H. SHEPHERD.—The lamp record system used by the electrical department of a large park system not only gives interesting facts on the life of lamps but also indicates apparatus trouble on the system.—*Electrical Review*, Dec. 20, 1919.

The Sheringham Daylight.—A device has been developed by George Sheringham to imitate very closely the daylight described as white diffused light from a north window. In this apparatus the light from an electric bulb (or other source of artificial light) is thrown on to a shade, on the under side of which is a color design worked out in accordance with the light absorption curve of the colors employed as determined by the Abney color patch apparatus. In effect, a portion of the red and yellow rays is absorbed, and the blues and violets are thus apparently reinforced.—London *Electrical Review*, Dec. 12, 1919.

Generation, Transmission and Distribution

Centralization and Conservation in Power Supply of Central Massachusetts.—F. L. HUNT.—The author brings out the economies that can be effected by the use of power from large central stations equipped with up-to-date machinery and the economical use of water power. He shows that by closing down 121 isolated plants and using central-station supply nearly 400,000 tons of coal were saved in one year in this particular instance.—*General Electric Review*, November, 1919.

Hydro-Electric Power and Its Use for Industrial Purposes.—ERIC A. LOF.—The development of electrochemical and electrometallurgical industries has in the last few years created a demand for electric power in large blocks. Other industries, such as the manufacture of paper and wood pulp, farming and agricultural work, irrigation, etc., require electric power in constantly increasing quantities. To meet these demands the

development of our water-power resources should be encouraged by the enactment of suitable legislation. —*General Electric Review*, November, 1919.

Annual Report of Hydro-Electric Power Commission.—A complete report of the activities of the Hydro-Electric Power Commission of Ontario for the year ended October 31, 1918. The report is divided into five parts, consisting of (1) legal proceedings, (2) transmission systems, (3) operation of the systems, (4) construction work of the commission, (5) general activities of the commission. There are 315 pages in the report and an abundance of illustrations.—*Report Hydro-Electric Power Commission of Ontario*, Toronto, 1919.

Water-Power Resources of British Columbia.—A comprehensive report issued by the Commission of Conservation of Canada showing that the Province of British Columbia has water-power sites aggregating 3,000,000 hp.—*Electrical News*, Nov. 15, 1919.

Electrical Characteristics of Transmission Circuits—V.—WILLIAM NESBIT.—In this number of the series the author deals with the effect of harmonies in the wave of voltage on long lines where the wave lengths of the harmonics may be not far from the lengths of the lines. He also deals with the heating of conductors suspended freely in air.—*Electric Journal*, December, 1919.

Traction

New Passenger Locomotives for St. Paul Rocky Mountain Division.—In this article are given particulars of the new passenger locomotives constructed by the Westinghouse Electric & Manufacturing Company. These locomotives have a capacity of 4,200 hp. for one hour without excessive heating. The normal starting drawbar pull is 100,000 lb. (22,000 kg.) The data for the locomotive may be summarized as in the table printed here. The description of the locomotives includes a discussion of the regeneration system employed for this service.—*Electric Railway Journal*, Jan. 3, 1920.

DATA FOR ST. PAUL PASSENGER LOCOMOTIVE FOR ROCKY MOUNTAIN DIVISION

Normal trolley voltage	3,000
Total weight	275 tons
Weight on drivers	336,000 lb.
Weight on leading trucks	66,000 lb.
Weight on trailing trucks	41,000 lb.
Total wheelbase	79 ft. 10 in.
Driving wheelbase	16 ft. 9 in.
Maximum rigid wheelbase	16 ft. 9 in.
Diameter of drivers	68 in.
Diameter of leading truck wheels	36 in.
Diameter of trailing truck wheels	36 in.
Locomotive capacity at 23.8 m.h.p. (one hour rating)	4,200 hp.
Locomotive capacity (continuous) at 80 per cent of above	3,360 hp.
Normal starting tractive effort	100,000 lb.
Normal speed on level track	55 m.p.h.
Capacity of steam boiler, per hour	4,000 lb.
Capacity of water tanks	25,500 lb.
Capacity of oil storage tank	750 gal.
Cab length	78 ft. 0 in.
Total over-all length	88 ft. 7 in.

Installations, Systems and Appliances

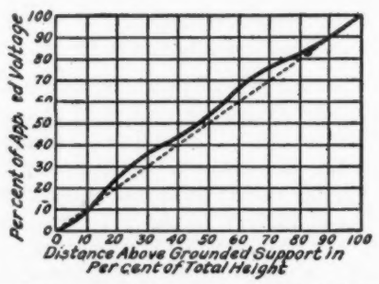
The Production of Electro-Medical Apparatus in Great Britain.—CUTHBERT ANDREWS.—The scope of this article is to show the general lines along which the British X-ray industry has advanced and to review the wide field which is now covered by electro-medical apparatus.—*Beama Journal*, October 1919.

Electrical Equipment Used in Precipitation of Material from Smoke and Gases.—This article deals with the apparatus used in electrical precipitation, shows how results are accomplished, enumerates the different fields of application and describes specific application of equipment to the work.—*Electrical Record*, November 1919.

Electrical Furnace as an Adjunct to the Cupola.—GEORGE K. ELLIOTT.—After explaining the difficulties encountered in attempting to superheat iron in a cupola, the author points out the advantage of obtaining high temperatures in melting and states why he believes the electric furnace is the ideal supplement to the cupola. He shows the advantage of the electric furnace as a refiner and explains how sulphur may be reduced and also how the excessive loss of manganese is avoided. —*American Machinist*, Dec. 11, 1919.

Electric Mine Hoists.—G. HACAULT.—In spite of the many improvements effected on the steam engine during recent years, electric drive for mine-hoists has proved superior, because of its great reliability, high economy and excellent adaptability to control at a distance. In this article various ways of arranging hoist drums and suspension cables are described, and a number of other mechanical and electrical details such as gear reductions, controllers, reversing switches and resistances are considered. The Brown-Boveri brake system is demonstrated. The service brake is put into action by a small auxiliary motor, which pulls the brake lever by means of friction coupling and screw drive. This electric brake system is said to take much less power than a corresponding compressed-air brake since the auxiliary motor consumes very little power except when applying the brake. Depth indicators, tachographs and various safety devices are also dealt with, and a schematic diagram is given showing a complete installation.— *Revue Générale d'Electricité*, Oct. 18 and 25, 1919.

Interchangable Bushings for High-Voltage Apparatus.—EUGENE D. EBY.—Some of the more important features of design and performance of the filled-type bushings are dealt with in this article. For high-altitude service the puncture strength of the bushing is not affected nor the strength of the insulating surface of the lower end of the bushing, which is entirely submerged in the oil. Installations at high altitudes, particularly those exceeding 4,000 ft. (1,200 m.) are supplied with high-altitude bushings whose upper section has been lengthened to increase the striking distance corresponding to the decrease in the dielectric strength of air at the high altitude. At high temperature air also decreases in dielectric strength. Thus a temperature of 40 deg. C. corresponds to a difference of 4,000 ft. in altitude. In order that the bushing shall not deteriorate under the voltage stress of normal service, the insulating surfaces should be entirely free from corona at all normal voltages and preferably also of double normal voltage or those voltages which may ap-



UNIFORM SURFACE DISTRIBUTION OBTAINED

pear occasionally on the line. To accomplish this a potential distribution is necessary which is uniform along the external insulating service of the bushing. This distribution is accomplished in the filled-type bushing by features of design involving the use of a metal sleeve btween porcelain shells within the bushing. This uniform distribution means uniform surface efficiency, so that the flashover voltage is proportional to the striking distance through the air from the top terminal to the grounded support. The ratings of bushings are therefore directly proportional to their linear dimensions. Corona within the tank is entirely suppressed by the use of grounded metal, which forms the central portion of the external shell of the bushing. The upper end of the sleeve is flanged to form a support upon the cover of the tank; the lower end extends below the surface of the oil. Thus all of the exposed surface of the bushing within the tank is at ground potential, and there can be no difference of potential along this surface and consequently no corona or static discharge on the bushing in the air space above the oil.—*General Electric Review*, November 1919.

Electric Logging.—R. E. GRAY.—The writer gives experience in logging operations in the West in which it was found economical to build special transmission lines for logging and to remove this line for use elsewhere after timber has been completely logged off. Motor and incidental difficulties encountered are also described in the paper.—*Journal of Electricity*, Dec. 1, 1919.

Electrophysics and Magnetism

The Influence of Chemical Composition and Thermal Treatment Upon Magnetic Properties, Specific Resistivity and Density of Iron Alloys.—E. GUMLICH and P. GOERENS.—In a long series of articles the authors report upon the results of experimental investigations into the properties of pure iron alloys which have been carried out in Germany for ten years or so under the co-operation of several scientific institutions and metallurgical concerns. Most of the measurements were made at the Reichsanstalt, hand in hand with metallographical studies conducted by Wüst and Goerens. Suitable samples with systematically varying percentages of C, Si, Al and Mn were carried through certain thermal and magnetical cycles, and extensive sets of data for each condition of the material were obtained. By extrapolation from the curves for the several series of alloys there were obtained, as probable averages, the following data for pure iron: Specific gravity, 7.876 gram/cm.^{3}; specific restivity, 0.0994 ohms/m., mm.^{2} at 20 deg. C.; temperature coefficient, 0.00573 per 1 deg. C.; magnetic saturation, 21,620 max./cm.^{2}. The effects of annealing upon the magnetic properties of commercial transformer plate were thoroughly investigated, the results leading to the conclusion that the annealing causes a decided deterioriation, the effect being worse the higher the temperature. During the first few hours, however, a net improvement is obtained, due to mechanical softening of the material and expulsion of gases, and there effects preponderate over the deterioration due to the annealing. Maximum improvement was observed in from four to twenty-four hours, and 785 deg. C. (1,440 deg. F.) appeared to be the most favorable annealing temperature.—*Elektrotechnische Zeitschrift*, June 26 and July 3, 10, 17 and 24, 1919.

Electrochemistry and Batteries

Electrical Treatment of Sewage by the Landreth Process.—A brief description of the Landreth direct-oxidation process for the treatment of sewage, in which both electricity and lime are employed.—*Chemical and Metallurgical Engineering*, Dec. 31, 1919.

Units, Measurements and Instruments

New Method of Measuring the Resistance of the Ground.—SHIRO SANO.—A new method has been devised for measuring the resistance of grounds consisting of earth plates buried in the earth. In this method, as devised by the author, the disturbing effect of the earth current is completely nullified and thus a great source of error is eliminated. The method is, moreover, essentially a nullifying method and hence has peculiar merits. The writer describes the method in detail and also discusses the nature of earth currents.—*Sibley Journal*, September 1919.

Telegraphy, Telephony and Signals

On the Theory of Radio-telegraphic and Radio-telephonic Receiver Circuits.—J. F. J. BETHENOD.—Proceeding from a theory of the approximate rectifying detector, the most advantageous proportioning of the constants of the secondary circuit of a receiver is obtained. The constants of the most desirable telephone winding and the value of the most suitable telephone shunting condenser are then derived.—*Proceedings Institute of Radio Engineers*, October 1919.

Internal Action of Triode Valves.—W. H. ECCLES.—A mathematical investigation of the fundamental processes involved in the triode valve.—*London Radio Review*, October 1919.

Miscellaneous

Protective Signs on High-Tension Lines.—G. DETTMAR.—Ever since 1906 the question of indicating to airplanes the position of transmission lines carrying dangerous voltages has had much consideration in Germany. It has been proposed to paint the poles in vivid colors, to put signs of enameled iron plate on top of the poles, etc. The author criticises in detail the varous suggestions made and concludes that none of the proposed systems appears to be practicable.—*Elektrotechnische Zeitschrift*, Sept. 11, 1919.

Thermal Expansion of Insulating Material.—WILMER H. SOUDER and PETER HIDNERT.—In the paper data are given on the thermal expansion of some of the more important insulating materials. In most cases the expansions are too irregular to justify the use of the general quadratic equations. A knowledge of the thermal behavior of these materials is essential before assembling them in certain types of apparatus subjected to wide temperature variations. The most striking peculiarities are: (a) the wide range in the values of the coefficients of porcelain from 1.6 to 19.6 millionths per unit length per deg. C. (b) the three varieties of expansions for porcelain, namely, straight-line, concave and convex expansion curves; (c) the shrinkage and the loss in weight of the phenol and similar compounds when subjected to excessive heat treatment; (d) the permanent growth and variations of different marbles when subjected to heat treatment; (e) the negative coefficient of expansion of marble at low temperatures.—*Scientific Paper, No. 352, of the Bureau of Standards*, Dec. 27, 1919.

SNOWSTORMS and the influenza in several sections of the country have greatly diminished buying of electrical materials. Construction forces, sales and clerical forces were hard hit by sickness, and deliveries, both local and interstate, have been tied up for several days. Stocks of raw materials are held up in several instances by the snows, and factory output on some steel materials for the electrical industry has suffered. Car shortage is playing havoc with steel mills, and the non-delivery of coal and coke is requiring the banking of several furnaces. Labor, too, at the coking furnaces is inadequate were there sufficient cars to move a greater output.

UPWARD price changes of 10 per cent were applied to schedule material and attachment plugs last week, and flexible armored conductor advanced $5 per 1,000 ft. Premiums of as high as $30 per 1,000 ft. have been paid to get rigid conduit from some manufacturers' warehouses. Pipe supply is extremely short, but hope is entertained of better shipments by March. Boxes, too, are short. Through increased capacity in the porcelain works, a better supply of wiring porcelain is expected in the spring.

BUILDING in general is progressing well, and new building plans continually being filed show the development expected along those lines as the year progresses. Collections are good.

BI-MONTHLY turnovers of lamp stocks were held to be impracticable by the midwinter meeting of the Atlantic Division of the Electrical Supply Jobbers' Association.

THE General Electric Company has floated $15,000,000 in twenty-year gold debenture bonds to retire notes maturing July 1, 1920.

AMONG important items of construction news are the proposed building of a 33,000-volt line from Stonington to Pawcatuck, Conn., by the Eastern Connecticut Power Company; the intended expenditure of $2,000,000 for two central power plants by the Cambria Steel Company; the application to the California State Water Commission for the diversion of water from the Tuolumne River for power and irrigation purposes in the Modesto district, dams, power houses and distributing system to cost $16,000,000; the plan to complete the Cedar Falls (Wash.) power plant to a capacity of 18,000 kw., bringing the total cost of the plant to $3,500,000; the projected expenditure of $2,000,000 in improvements to the Pacific Power & Light Company's system, and the commencing of the construction of a 60-mile, 66,000-volt transmission line from Winnipeg to Portage la Prairie, Manitoba.

PUBLIC SERVICE COMMISSIONER NIXON has been assured by the federal Railroad Administration that no more coal cars consigned to public utilities in New York City will be diverted, and the fuel crisis in that city is thought to be over.

News in Brief

SUMMARY

of Important Happenings in the Industry During the Week

IN THE revision of the National Electric Safety Code of the Bureau of Standards, which is now approaching completion, the rules on guarding live and moving parts, grounding conduit and frames and marking neutral conductors, as contained in Part 3, will be considerably changed.

A PROTEST has been made by the National Electric Light Association against the practice of the federal Bituminous Coal Commission of charging public utilities higher prices for contract coal, in order to meet the higher wages, on the ground that the utilities are prohibited from passing this increase on to the consumers.

BEFORE a joint meeting of the Boston Sections of the A. I. E. E. and A. S. M. E. the advantages of turbines rated at 30,000 kva. and more were questioned by Farley Osgood of the Public Service Company of New Jersey.

AN UNUSUAL system of street lighting, designed to provide for a summer resort more elaborate illumination in the busy season than in the winter time, has been designed by W. D'Arcy Ryan for Saratoga.

HERBERT C. HOOVER, who will be inaugurated as president of the American Institute of Mining and Metallurgical Engineers on Feb. 17, will at that time present a plan for the better working of the bituminous-coal industry.

THE MEMBERS of the Congressional conference committee on the water-power bill are now free to begin their sittings and are expected soon to do so.

THE seventy-third anniversary of the birth of Thomas A. Edison was the occasion for congratulations to him from all parts of the world. A luncheon at the West Orange works was given by the Edison Pioneers, and the employees met Mr. and Mrs. Edison at a ball.

THE UNUSUAL shortage of water in California due to the long drought still threatens curtailment of power. In the southern part of the state, however, conditions have been improved by a general heavy rain on Feb. 8 and 9.

SINCE the first of the year fourteen prominent electric light, heat and power companies have offered short-time note and bond issues to the public totaling $43,768,000. Of these securities eight bear interest at 7 per cent.

THE results of a detailed study of farm-line standardization have been embodied in a report to be made at the June meeting of the Iowa Section, N. E. L. A., by its farm-line committee.

AT A MEETING of the Institute of Radio Engineers F. M. Ryan, J. R. Tolmie and Roy O. Bach reported having held two simultaneous radio-telephone conversations over a distance of five miles. The conversations could have been increased to five had there been enough apparatus on hand.

THE annual report of the Brooklyn Edison Company for 1919 shows a net income after deductions for interest and reserve of $1,806,413, as compared with $1,593,559 last year, and a surplus of $318,007, as compared with $97,809.

THE Pennsylvania Water & Power Company reports a gross income for 1919 of $1,823,006 and a net revenue of $766,406, of which $509,700 was paid in dividends.

IN THE Maryland plant of the Bethlehem Steel Company there are now 2,169 motors on the electrical system, representing a total connected load of 117,850 hp., according to R. B. Gerhart, superintendent of the electrical department.

A PUBLIC hearing by the advisory committee of the National Fire Protection Association will be held in New York on March 23 and 24 to consider numerous changes in the National Electrical Code recommended by the electrical committee, some of them of much importance.

EXTENSIVE additions to its facilities, involving interconnections between generating and distributing systems in West Virginia and Kentucky, are being made by the Kentucky & West Virginia Power Company.

News of the Industry

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields

Edison Hard at Work on Seventy-Third Birthday

ON WEDNESDAY of this week Thomas A. Edison celebrated, with his employees and old time associates, his seventy-third birthday, which found him in splendid health.

At his arrival at the works in West Orange, N. J., in the morning there was an impromptu reception and welcome in the works by the employees. He was met at the gates by the older men, some of whom had been associated with him for almost forty years. Mr. Edison received a large number of gifts.

In his customary fashion "the old man" escaped from the gathering and was soon found hard at work in his laboratory.

At noon The Edison Pioneers met at the works for their annual meeting and luncheon.

All of the employees met Mr. and Mrs. Edison at night at a big ball held at the Orange armory.

Higher Prices on Contract Coal to Utilities Cause Protest

A PROTEST has been made by the National Electric Light Association against the practice of charging public utilities higher prices for contract coal, in order to meet the higher wages, on the ground that the Fuel Administration would not permit this advance to be passed on to the consuming public.

President R. H. Ballard and Executive Manager M. H. Aglesworth addressed the protest on Feb. 5 to Henry M. Robbins, chairman of the United States Bituminous Coal Commission, stating that certain coal operators were justifying higher coal prices because of contracts existing on Oct. 30 providing for automatic increases in price where miners' wages were raised. The letter stated that it was the understanding of the N. E. L. A. that when the wage adjustment was agreed upon it was expressly provided that the increased wages would not be passed on to the public in higher coal prices.

Attention was directed to the fact that the electric light and power companies are regulated by state and municipal authorities and are not permitted to earn more than a fair rate of return upon their valuation. As a result increased operating expenses must be borne by the consuming public.

No answer had been received by the N. E. L. A. to this letter by Tuesday.

It is understood that the Attorney-General has taken the position so far that prices of coal fixed by the government do not apply where contracts made prior to Oct. 30 exist between the coal operators and public utilities. In that case it is a matter between the two parties to the contract to determine whether or not the 14 per cent increase in miners' wages shall be charged to the utilities

In any event it was the intention of the N. E. L. A. executives to point out to the Bituminous Coal Commission that increases in coal prices to public utilities must necessarily be borne by the consuming public.

Hoover to Offer Bituminous Coal Plan

HERBERT C. HOOVER is about to announce a constructive plan for the better working of the bituminous-coal industry. Upon his inauguration as president of the American Institute of Mining and Metallurgical Engineers on Feb. 17 Mr. Hoover and Horace V. Winchell, the retiring president, will present a plan dealing with practically every problem of the bituminous situation, which it is announced will be discussed by prominent government officials and bituminous-coal operators. Members of the A. I. E. E. attending the midwinter meeting of the Institute next week are invited to participate.

The scope of the plan presented by Mr. Hoover comprises the causes of intermittency; how and when the irregularities occur; the actual number of days worked by the men during each season of the year; a possible alteration in the wage basis; actual wages received by workers during each season of the year and the question of storage in all its phases and as to all possible places for storage, such as at the mine, at the industrial plants, etc.

The following formal papers will be presented on the fundamentals of the problem, on which it is expected a satisfactory solution may be based: "Problems of the Coal Industry," by Van H. Manning, director of the United States Bureau of Mines; "Fluctuation of Production of Coal," by George Otis Smith, director United States Geological Survey; "Storage of Bituminous Coal and Its Possibilities of Stabilization," by H. H. Stoek, University of Illinois, Urbana; "Transportation as a Factor in Irregularity of Coal Mine Operation," by G. W. Reed; "Stabilizing the Market," by Eugene McAuliffe, president Union Colliery Company.

Way Now Clear for Water-Power Bill Conference

WITH the conclusion of the Congressional conference on the railroad bill it now will be possible for the conferees to begin the consideration of the water-power bill. Owing to the fact that several of the conferees selected to thresh out the differences between the Senate and the House on the water-power bill also were members of the conference on the railroad bill, it has been impossible to have even a preliminary meeting on the water-power bill. Since the work on the railroad bill has been exceedingly confining, it is probable that intensive work on the water-power bill will be deferred for a week or so in order that an opportunity may be given the conferees to catch up with the work in their offices.

Power Companies Pay High Rates For Money

FOR the past few months the money market has been soaring, and public utilities which have planned immediate financial betterments have had to pay an unusually high rate of return to investors. Since the first of the year some fifteen prominent electric light and power companies have offered either note or bond issues to the investing public, totaling $43,768,000. The Union Light, Heat & Power Company of Covington, Ky., issue of $2,150,000 first mortgage 7 per cent five-year gold bonds is the only one to be offered at par. The Blackstone Valley Gas & Electric Company of Pawtucket, R. I., is offering twenty-year gold bonds bearing 5 per cent interest, at 10 points below par. On the average, however, public utility securities bearing an interest rate of 6 or 7 per cent are being offered at from half a point to ten points below parity, yielding a return of about 8 per cent to the investor.

The more prominent issues since the first of the year are as follows:

Company	Amount of Issue	Period	Class of Security	Rate of Interest	Offered at
Baton Rouge Elec. Co.	$300,000	3-year	Gold notes	7	98½
Philadelphia Suburban Gas & Electric Co...	1,680,000	3-year	Gold bonds	6	97
Little Rock Elec. Co...	1,000,000	1-year	Gold notes	7	99½
Portland, (Ore.) Railway, Lt. & Pwr. Co.	2,000,000	1, 2 and 3-year	Gold notes	7	—
Republic Ry. & Lt. Co.	1,444,000	3-year	Gold notes	7	97½
San Joaquin Light & Power Co.....	494,000	———	Preferred stock.	6	94½
So. Calif. Edison Co....	7,500,000	25-year	Gold bonds	6	96
Blackstone Valley Gas & Electric Co.....	500,000	20-year	Gold bonds	5	90
Union Light, Heat & Power Co.....	2,150,000	5-year	Gold bonds	7	100
Wisconsin - Minnesota Light & Power Co....	600,000	1-year	Gold notes	7	99½
General Gas & Elec. Co.	4,250,000	10-year	Gold bonds	6	—
Vermont Hydro-Electric Corporation	1,350,000	———	Gold bonds	6	94½
Consumers' Power Co .	5,000,000	10-year	Gold bonds	7	98
Consumers' Power Co.	3,000,000	2 to 7 years	Gold debentures	7	—
Philadelphia Elec. Co..	12,500,000	2-year	Gold notes	6	97½

Diversion of Public Utility Coal Cars Ordered Stopped

AS A RESULT of representations made last week to Washington the federal Railroad Administration has assured Public Service Commissioner Lewis Nixon of New York City that no more coal cars consigned to public utilities would be diverted. It was reported in these columns last week that the public utilities in and around New York City were threatened with a coal shortage which to a certain degree was the result of diversion by the Railroad Administration of coal plainly marked for public utility service.

In the past week the coal supply has been satisfactorily increased and the threatened shortage has, temporarily at least, been overcome.

Although an unusual amount of snow has fallen in the past week, the temperature has been moderate and consequently less severe ice conditions in the harbor have had to be contended with. As a result it has been possible to dock and unload more coal barges.

Curtailment of load is threatened on the system of the United Electric Light Company, Springfield, Mass., unless the diversion of coal by the railroads is greatly reduced. The United company has 200 carloads on the way, but points out that seizures have been occurring, nothwithstanding numerous official telegrams stating that coal destined for public utilities would not be molested. There is at present a shortage of hydro-electric power in central New England, and the larger steam stations are being heavily drawn upon.

Bi-Monthly Lamp Stock Turnover Impracticable, Jobbers State

LAMP stock turnovers and unsatisfactory margins of profit in certain lines were uppermost in the discussions at the midwinter meeting on Monday of the Atlantic Division of the Electrical Supply Jobbers' Association held in New York at the Commodore.

The main topic of the morning session was the report of the lamp committee, given by F. S. Price, the chairman. His subject was: "Is it practicable for jobbers to obtain the turnovers on lamps as now required by lamp manufacturers in their new rider?" From letters Mr. Price has received from jobbers it appears that they believe six turnovers a year are not practicable. At the same time, the lamp manufacturers are willing to go further and consider what the jobbers think would be a fair rate of turnover. The work of the lamp committee was commended in a resolution.

During the discussion the "new thought" idea, as represented by the Conference Club, was mentioned, and W. L. Goodwin was asked to explain the underlying features of this movement.

George W. Provost, Pittsburgh, outlined the state of the iron and steel market today, bringing out the fundamental reasons for the present shortages. Frank A. Merkel outlined the purposes of the new publication, the *Jobbers' Salesman.*

E. W. Rockafellow, general supply sales manager of the Western Electric Company, led the afternoon session in a discussion as to whether or not electrical heating devices constituted a profitable line for jobbers. Remarks from jobbers and manufacturers attested the unprofitableness of the sales of these appliances to all concerned, except retail jobbers, under present methods of distribution. The division recommended a conference between its heating-device committee, the licensees and licensors in connection with the cost of warehousing, distributing and retailing heating devices.

Further resolutions called the attention of the division's outlet-box committee to the unsatisfactory conditions of the outlet-box industry today and recommended to manufacturers of schedule material the doubling of list prices to do away with plus discounts.

At the close of the session A. M. Little, president of the Mohawk Electrical Supply Company, Syracuse, N. Y., was elected chairman of the division.

Clearing House on Chicago Code Changes

Some electrical manufacturers have complained that the department of electricity of the city of Chicago has incorporated in its working code numerous changes without giving sufficient notice to the manufacturer whose product is affected. In order to assist in remedying this condition, J. W. Collins, secretary of the Electrical Contractors' Association of the city of Chicago, 506 West Washington Street, has established his office as a clearing house for information of this character. Mr. Collins has announced that he will be pleased to notify any manufacturer selling goods in Chicago of proposed code changes which will affect their products if they will file with him a request for such information.

New National Electric Safety Code Requirements

Marking Neutral, Grounding Frames, Use of Safety Switch Above 150 Volts and Inclosed Elevator Wiring Are Among Changes

RULES on guarding live and moving parts, grounding conduit and frames and marking neutral conductors will be considerably changed in Part 3 of the National Electric Safety Code of the Bureau of Standards. Suggestions from every possible source are being used to revise the code before the next edition is printed. Part 3 is now probably in its final shape. This part is devoted to electrical utilization equipment operated at 25 volts to 750 volts and accessible to other than qualified operators.

As a result of the changes the rules on guarding now require that a screen or inclosure be placed around all dangerous equipment which is less than 8 ft. (2.4 m.) above the floor. This equipment includes bare wires of any voltage, open insulated wiring above 300 volts and live parts of motors and switchboards. Fuses and circuit breakers must be so guarded that an arc from them will not burn an operator. A screen must be used to protect operators from mechanical injury by moving objects such as an oil-switch handle. Metal parts on the top of railway cars shall be insulated or guarded. If it is necessary for an operator to enter any of the inclosures, the screens must be of insulating material or be substantially covered with such material.

Grounding the neutral wire and the metal equipment that carries no current is now ordered instead of recommended. The length of conduit, armored cable and metal raceways allowed to be installed ungrounded was set at 15 ft. (4.5 m.).

Another safety measure that is ordered is marking the neutral or grounded conductors and terminals or so arranging them that they can be readily identified. Connecting cords for attaching to portable devices with cases designed to be grounded shall be constructed for easy identification of the grounded conductor. Regarding the size of neutral conductors, the rule now states that they must be sufficiently large to carry the maximum current to which they can be subjected, but this does not necessarily mean as large as the outside conductors, as was formerly approved.

The ruling on fusible switches for over 150 volts now states that the switch must operate so that before the fuses can be touched they must have been disconnected from the line. This voltage limit was formerly 300.

All sizes of separately excited direct-current and series motors, motor-generators and converters must now be provided with speed-limiting devices unless connected to such a load as will safely limit the speed or unless the machine is always under manual control of a qualified operator. Another change states that motor starters (except auto starters) which disconnect all supply wires need not have a disconnecting switch.

Some additions were made to the rules on electric cranes and elevators. Among them is a paragraph stating that in an elevator shaft all circuits except the flexible leads to the elevator must be run in metal conduit or armored conductor securely fastened and grounded, that all live parts must be inclosed, that no other circuit shall have an outlet in the shaft, that 750 volts is the maximum allowed, and that signals must be operated at not over 300 volts. Another rule requires travel-limiting switches for cranes and elevators, and a limit of 4 ft. (1.2 m.) above the floor is required in rooms where inflammable gas is present. Protection against reverse-phase operation of elevators and cranes is required by another addition to the rules.

The rules of the Industrial Lighting Code prepared by the Illuminating Engineering Society are recommended for all shops and factories. More specific changes applying to lighting theaters and public halls require that exit and other lights shall be on separate circuits from the stage lights and general house lights and shall be controlled from the front of the house.

Advantages of Units Rated at 30,000-Kva. and More Questioned

IN A FRANK discussion of the advantages of moderate-sized steam turbines from the operating standpoint, Farley Osgood, general manager Public Service Electric Company, Newark, N. J., declared before a large meeting of the Boston Section of the A. I. E. E. and A. S. M. E. on Feb. 3 that the use of 30,000 kva. rating and upward imposes substantial burdens from the maintenance point of view and may impair the service standards unless turbines are selected with a sharp eye upon their relation to the sales policies of public utilities. The speaker pointed out that the art of turbine design cannot advance unless some experimental failures are endured, but that closer co-operation is desirable between manufacturers and operators.

An analysis of forty-four systems, Mr. Osgood pointed out, showed that 16 per cent of the station capacity was in individual units. The 11.8 lb. of steam per kilowatt-hour water rate of the 30,000-kva. turbine is, of course, a decided gain over 12 lb. to 14 lb. in 25,000-kva. units and 16 lb. in 5000-kva. sizes, but many other points besides economy need consideration, especially continuity of service. Units of 20,000 kva. and 25,000 kva. were favored. Twice as long, it was pointed out, may be required to open and examine a 35,000-kva. unit as a 25,000-kva. set under present conditions, and the operating man needs to get away from special tools, special inspectors and maintenance. Wider separations between wheels and disks were urged. Simple auxiliary equipment, half motor-driven and half steam-driven, was advocated, with direct-connected exciters and adequate spare excitation capacity, steam-driven. Four boilers per unit and a maximum of twenty-four boilers per plant were favored.

A vigorous defense of the larger units was made at the meeting by Nicholas Stahl, general engineer Narragansett Electric Lighting Company, Providence, R. I., who cited the production without a shut-down, of 30,000,000 kw.hr. in the past fifty-one days by a 45,000-kva. set at Providence. The use of larger boilers was also favored on account of labor economies and the higher type of personnel secured for a given outlay. The speaker said that the co-operation obtained between electric railways represented in the American Electric Railway Association and manufacturers of car and other equipment might well be emulated in central-station manufacturing relations.

C. F. Mosher, superintendent of stations, Turners Falls (Mass.) Power & Electric Company, emphasized the importance of fixed charges in relation to station load factor, and R. E. Dillon, assistant superintendent

generating department, Boston Edison Company, illustrated the importance of carrying through complete estimates of different equipment combinations before selecting apparatus. R. H. Rice, manager Lynn Works, General Electric Company, affirmed the desire of the manufacturers to co-operate in every possible way with the turbine purchaser, pointing out that the results of heat treatment are not materially uncertain provided that steel manufacturers adhere to specifications. He stoutly defended the development of units designed to show increasing fuel economy. E. H. Sniffen, manager of the power department of the Westinghouse company, also expressed co-operative intentions and hoped that turbine development might be affected somewhat apart from pure commercialism in future.

Closing, Mr. Osgood urged conferences over proposed new designs between manufacturing and operating interests.

Inter-connections in Kentucky and West Virginia Coal Fields

IMPORTANT and extensive additional facilities are being provided by the Kentucky & West Virginia Power Company for interconnecting generating and distributing systems in the southern West Virginia and eastern Kentucky coal fields. To do this the company has acquired the Logan County Light & Power Company, Logan, W. Va.; the Tug River Power Company, Sprigg, W. Va., and the Kentucky River Power Company, Hazard, Ky., to supply electricity to the various coal mines in the section referred to.

The power plant at Logan, with a capacity of 15,000 kva., will be enlarged by installing two 15,000-kw. turbines. Plant facilities will be increased to correspond, and energy will be stepped up in voltage to transmit over an 88,000-volt line to Hazard mine, a distance of 75 miles (120 km.). Construction has already been started on this line, and it will be completed as far as Pikeville, Ky., in 1920.

At Sprigg a 3,000-kw. turbine and corresponding apparatus are being installed.

At Hazard the boiler room will be extended and a 3,000-kw. turbine will be installed. The 44,000-volt and 33,000-volt distribution lines in each district will likewise be extended. At Pikeville, Ky., a 10,000-kva. step-down substation will be installed on the 88,000-volt transmission line and 44,000-volt distributing lines extended to serve all the coal companies in the Big Sandy River field. It is probable that a 20,000-kw. steam electric plant will be built at this point.

The work outlined will extend over a period of two years. The officers of the Kentucky & West Virginia Power Company are R. E. Breed, president, and George N. Tidd, vice-president, both of New York. The company is managed and operated by H. T. Hartman, vice-president, Land Title Building, Philadelphia.

General Electric Sells $15,000,000 of Debentures

THIS week the General Electric Company floated a fifteen-million-dollar twenty-year 6 per cent gold debenture bond issue to secure funds to pay $15,000,000 notes maturing July 1, 1920. The issue was quickly oversubscribed by investors at 94½, giving a yield of about 6½ per cent. The bonds are redeemable at the option of the company at 105.

The growth of the General Electric Company in the past few years has been very large. Sales billed rose steadily from $85,522,070 in 1915 to $230,750,010 in 1919. Last year's billing topped the 1918 record by $14,000,000. Net income available for interest charges in 1915 was $12,307,995 and in 1919 was $38,685,067.

The preliminary balance sheet of the company as of Dec. 31, 1919, showed assets, after deducting current liabilities, in excess of $217,000,000

Public Hearing on Proposed Code Changes

Numerous Changes Recommended by Electrical Committee of National Fire Protection Association that Deserve Wide Consideration

NUMEROUS changes in the National Electrical Code have been recommended by the electrical committee of the National Fire Protection Association, and a public hearing by the advisory committee will be held in the rooms of the New York Board of Fire Underwriters, 123 William Street, New York, March 23 and 24, at which a vote will be taken on the proposed changes. Several recommendations stand out above all others. Among them are (1) the recognition of varnished cloth for open and conduit wiring where it is permanently dry or corrosive vapors exist; (2) the omission of insulating joints and canopy insulators from straight electric fixtures when they are permanently grounded and under certain other conditions; (3) the prohibition of grounded two-wire direct-current systems unless exposed to leakage or induction from high-voltage circuits; (4) the compulsion to ground alternating-current secondaries unless they are entirely unexposed to the aforementioned leakage and induction; (5) the freedom to use short runs of metallic conduit and the like without grounding; (6) raising the division point between low potential and high potential to 750 volts; (7) requiring inclosed externally operated service switches except where switches are under competent supervision; (8) the prohibition of voltages higher than 2500 for direct operation of motors except in central-station buildings. Parts of the 1918 Code referring to the protection of motors (particularly Rules 8b and 8c) have been revised almost in total. New sections have been added on elevator wiring and isolated light and power equipment for less than 50 volts.

In addition, greater thicknesses of insulation have been recommended for 1,500-volt to 3,500-volt rubber-covered cables, and stranding has been standardized. In view of the expected use of varnished-cloth-insulated wire brief specifications are given. Where distribution circuits originate in an attended station a ground detector must be employed unless the system is permanently grounded. When generators or motors operate at potentials above 750 volts their frames must be grounded except where this is impracticable. In such cases the frames must be permanently and effectively insulated and isolated from grounded surfaces by covers, cages, insulating mats, etc.

Grounding is covered quite extensively in the proposed changes. Aside from the features mentioned, the recommendations (1) prohibit the use of any part of a metallic conduit as part of the ground conductor; (2) prevent the interconnection of ground conductors for wire runways with circuit ground conductors or a grounded circuit conductor except when the former is

grounded at three or more services; (3) require that grounds must have a capacity not less than one-fifth that of the grounded conductor at the point attached. Each ground on alternating-current secondaries after the first three must not be smaller than No. 10 copper wire, but need not be larger than No. 1/0. If heaters are operated at pressures above 150 volts to ground, they must be permanently grounded.

SPECIFICATIONS REGARDING MOTOR PROTECTION ARE CONSIDERABLY REVISED

In the recommendations on motor protection the electrical committee proposes putting an automatic cut-out in each conductor and specifies the number of overload trip coils that must be used with circuit breakers with different systems. Except under expert supervision the breakers must be supplemented by fuses. Alternating-current starters may be used for breakers under certain conditions. Continuous-rated motors protected by automatic cut-outs set for over 10 amp. must be protected by running fuses or breakers having a current capacity of 110 per cent of the name-plate rating. Short-time-rated motors must be protected by fuses, time limit breakers or instantaneous breakers rated according to values given in a table. Small motors may be grouped under the protection of a single fuse provided that the group demand does not exceed 660 watts. Conductors to motors must have a capacity equal to 110 per cent of the name-plate rating and must not be fused above this capacity. Breakers may be set for not more than 30 per cent higher values unless protected by fuses. Switches controlling motors must indicate whether they are open or closed, while devices cutting out protective apparatus during starting must automatically return to the off position when released. When switches are installed without protective devices they must have one pole in each ungrounded circuit.

Recommendations are also given for installation in hazardous places such as lacquer and varnish rooms.

When multiple-conductor service leads are installed where they may come in contact with awnings and the like they must be inclosed in conduit. Elsewhere they must be supported at least 6 in. (15 cm.) from adjacent woodwork and 12 in. (30 cm.) from overhanging combustible material unless protected. Service wires must not be smaller than No. 10 soft copper or No. 12 medium or hard-drawn copper. With approved racks or brackets exterior wiring not protected by cut-outs can be supported not more than 9 ft. (2.7 m.) apart and 2 in. (5 cm.) from surface over which they run. Power and communication wires on the same poles must never be on same crossarms and must be at least 24 in. (60 cm.) apart vertically for 300 volts and not less than 30 in. (76 cm.) for higher voltages.

RULES ON ELEVATOR WIRING ADDED

The recommendations on elevator wiring, which include eleven sections, refer chiefly to placing motor disconnects in sight of the motor, grouping wiring between the motor and controller, flame-proof coverings for conductors to main-circuit resisters, covering flexible or traveling cables, permission to omit grounds on conduit or armored cable attached to elevators, incasing signal wiring, placing spark-emitting devices at least 4 ft. (1.2 m.) above the lowest floor level, and incasing conductors in elevator shafts.

Regarding wiring standards and systems the committee recommends that all conductors of No. 6 and larger must be stranded for conduit work. A table is given showing the size of conduits for different numbers and sizes of wire and cable for various systems. When sockets are located where flexible cords are not liable to be attached up to 4,000 watts may be dependent on final cut-out. In such cases Mogul sockets and No. 12 wire must be used. Tables on clearances for dry or excessively hot places and locations exposed to dampness and injurious fumes are given.

Recommendations are also given on car-house wiring, outlet boxes, cabinets and cut-out boxes, use of flexible cords, ground clamps, wiring to motors operating at 500 volts or more, and theater and garage wiring.

An attempt is being made to reconcile the National Electrical Code with the National Electrical Safety Code, but fundamental differences exist regarding insulating joints and voltage limits.

Fifteen Million Dollar Street-Lighting Program for Chicago

RECOMMENDATIONS have been made to the Chicago City Council by William G. Keith, commissioner of gas and electricity, that the voters of the city be asked to approve a fifteen-million-dollar bond issue to provide for the installation of 85,000 new 100-cp. electric street lamps and for the rehabilitation of the present system. The details of the plan are as follows:

Installation of 500 miles of new street lighting with 34,666 100-cp. lamps; along street car lines, two lamps to each trolley pole; cost, $5,546,560.

Displacement of 9,500 gas and gasoline lights in 376 miles of street with 26,068 100-cp. electric lamps; cost, $4,170,880.

Installation of lamps immediately south of Jackson Boulevard, from the river on the north to Twelfth Street, and from the river on the west to Lake Michigan; cost, $525,000.

Displacement of 6,000 600-cp. aërial lights in 350 miles of streets with 24,266 100-cp. lamps; cost, $3,882,560.

Changing 8,600 100-cp. lamps from high-tension circuits to the group system; cost, $215,000.

Installation of safety island lights at 500 intersections of streets; cost, $175,000.

Erection of warehouse and garage to take the place of three structures now in use; cost, $485,000.

Multiplex Radio-Telephony Possible

TWO radio-telephone conversations through a single antenna over a distance of five miles was the accomplishment reported by F. M. Ryan, J. R. Tolmie and Roy O. Bach at the Feb. 4 meeting of the Institute of Radio Engineers, held in New York City. The paper was read by Mr. Ryan, who is now connected with the Western Electric Company in radio research work. Mr. Ryan said that as many as five telegraph messages were being sent or received simultaneously with a single antenna, and that as many telephone conversations could have been carried on had there been sufficient apparatus at hand. The method used was that of a number of radio frequencies with a series antenna circuit. The calculations of the circuit were also shown. The meeting was conducted by the president, J. V. L. Hogan.

Standardization in the German Industry

Mechanical and Electrical Manufacturers to Unite on All-German Systems of Standards for Parts, Details and Types

WITH industrial and commercial conditions getting back more and more to a normal state, German engineers are planning a great campaign for rebuilding peace-time industry and re-establishing foreign trade relations. An important point in this campaign, as it is being mapped out just now, is a system of standards for the electrical and mechanical industries, intended to be universally accepted among German producers and consumers and aiming to increase the industrial overall efficiency and to cut unnecessary cost items in production.

Upon suggestion from the Department of Interior Economy, the Verein Deutscher Ingenieure has formed a standardization committee, called the Normenausschuss für die Deutsche Industrie, usually referred to as "Nadi." This committee and its associated twenty-five sub-committees for different industrial branches are working out a most far-reaching system of standard specifications, not only for materials, stock dimensions and semi-finished products, but also for spare parts of various kinds and even further for complete units of machinery.

The standardization work is divided into three groups—dimensional and detail, type, and specialization. The dimensional work is concerned with the establishment of standard forms and dimensions for all sorts of machine elements and parts of apparatus, etc., such as screws, bolts, washers, and so on, and in the electrical industry fuses, lugs, porcelain pieces, switchboard supplies, etc. Thus the existing ten screw systems have been by one stroke reduced to two, all parts having agreed to use only German standard metric threads for screws up to 6 mm. ($\frac{1}{4}$ in.,), the Whitworth system being also allowed above this dimension. In the electric signaling industry the standardization work has begun from the very bottom. A great number of preliminary standard drawings of such small parts as screw connectors, contact springs, lugs and insulating washers have been circulated for criticism and are now back for final action. Several such standard drawings are reproduced in the *Elektrotechnische Zeitschrift* of Sept. 4 and 18, 1919.

The aim of the type standards work is to unite all manufacturers on certain lines and certain types of standard machinery. The types are to be defined by rating, voltage, speed, etc., and also by size of shaft, base dimensions and similar data, because of the bearing upon the interchangeability of makes and upon the question of reserve equipment. In the case of electric railway motors it is even intended to establish standards so exacting that a damaged motor may be directly replaced by another of any make whatever, without any electrical or mechanical adjustment work. A start has been made on transformer standardization, so far, of sizes up to 100 kva., inclusive. One normal line of seven sizes has been agreed upon and also one five-step line for agricultural use. Not only are primary and secondary voltages fixed, but also efficiency, core losses and coil losses, and even details such as arrangement of bushings and inlets and outlets for oil. The specifications also take up definite figures for short-circuit reactance drop, so as to insure satisfactory parallel running of the future standard transformer units, irrespective of make.

In the past German industry has been ruled by financial combinations. All makers of a certain article were united for the purpose of controlling prices of their own product, if necessary by aid of dumping, and on the other hand, by means of systematic bargaining, to lower prices of necessary raw material and supplies. The industrial bureaucracy thus had of old a strong foot hold in Germany, and it is now intended to kill even such internal competition as the old system fostered, putting in its place specialization and co-operation on the basis of "Nadi's" standards. The plan is, therefore, to weld the entire German industry into one giant concern, organized under control of the government, ruled by committees under the national engineering societies, and systematically co-operating to cut costs, increase efficiency, and, in avoiding waste due to internal competition to direct its energy to competition in the world markets.

Fear of Oil Shortage Limits Adoption of that Fuel

ALTHOUGH oil has many advantages as a fuel, the uncertainty as to the future of the fuel-oil supply is preventing many operators from changing over their coal-burning plants to burn oil. This is a summary of opinions given at the annual meeting of the American Society of Heating and Ventilating Engineers, New York City, Jan. 27-29. The three main causes of this uncertainty are (1) the fact that the actual amount of oil that can be taken from the wells is definitely limited, (2) the uncertainty of the policies of the government of Mexico, from which country comes practically all our fuel oil, and (3) the shortage of boats for transportation. Among the papers prepared on this subject were: "Oil as a Fuel for Boilers and Furnaces," by H. H. Fleming; "Oil Fuel," by F. W. Staley; "Fuel-Oil Equipment," by John P. Leask; and "Oil Fuel Versus Coal," by David Moffat Myers.

Street-Lighting System for Busy and Off Season Use

AN UNUSUAL system of street and park lighting has been designed for Saratoga, N. Y., a village of 15,000 population which is a thriving summer resort four months of the year but cannot well afford an expensive system the year around. The new system, therefore, which was designed by W. D'Arcy Ryan of the General Electric Company, provides for two kinds of lighting each suitable for the time of the year that it is used.

Ornamental poles, some with one and some with two globes, in each of which will be two lamps, one a 1,000-cp. "Mazda" and the other a 250-cp. "Mazda," are proposed. In the base is a relay box.

For lighting in the busy summer season the 1,000-cp. lamps will be used until midnight, after which the 250-cp. units will be used. The change is regulated from the power house.

During the remainder of the year the 250-cp. units supply the required illumination.

Work on installing this system is expected to begin next month so that it will be in readiness for use this summer.

Water-Power Attracts New Industries to Community

IN ITS tenth annual report the Pennsylvania Water & Power Company gives a "statement of condition" as of Dec. 31, 1919, which shows total assets of $21,305,091. Of this $17,538,226 represents plant, property and power development. The gross revenue for the year was $1,823,006 and the net revenue $766,406, of which $509,700 was paid in dividends.

Charles E. F. Clarke, the president of the company, dwells on the value of hydro-electric power as emphasized in the last few years, pointing out how new industries are attracted to a community where there is a large supply of unused energy to draw upon. The small labor force required for the operation of a water-power plant and its freedom from the problem of obtaining an adequate supply of fuel, with the attendant difficulties of transportation and the steadily mounting prices, are great factors in the growing popularity of hydro-electric installations. The president also announces that operating expedients growing out of the necessities of war conditions led to considerable development in the technical details of handling the combined operation of steam and water-power generating plants.

Brooklyn Edison Company Reports Successful Year

THE annual report of the Brooklyn Edison Company for 1919 shows that the company met successfully the difficulties and problems of the readjustment period. An extensive new-business campaign resulted in power contracts for upward of 67,000 hp., many of which were made with firms previously served by private plants Contracts were signed for wiring more than a thousand buildings where gas had hitherto been used. The company had 125,524 customers on Dec. 31, an increase of 26,262 over the year previous.

The financial results for the year show a total revenue of $10,850,114, as compared with $8,854,302 in 1918; a net income after deductions for interest and reserve of $1,806,413, as compared with $1,593,559, and a surplus after the payment of dividends of $318,007, as compared with $97,809.

Boston Edison Buys Land for New Super-Power Station

WITH the intention later of erecting thereon a super-power station, the Edison Electric Illuminating Company of Boston, Mass., has purchased a 21-acre tract of land in Weymouth, opposite the works of the Fore River Shipbuilding Company and situated on tide-water. The company's main generating station at L Street, now rated at about 115,000 kw., can be enlarged by the addition of another unit of 30,000 kw or 40,000 kw. rating before it will be necessary to build the proposed new station. It is therefore unlikely that construction will begin for a year or two.

The company's load is growing very rapidly, more than 25,000 kw. in connected load having been added since Nov. 1, 1919, and there is every indication that more than 60,000 kw., in new business will be taken on by summer, including that already mentioned. Interconnection with the central stations to the north and south of Boston is steadily developing, and the recent tie-in of the Edison company with the New England Power Company marks a further step toward wider service in central New England. At the new site in Weymouth ample coal-storage and condensing-water facilities will be enjoyed, and there are opportunities for the development of a large industrial load.

Bond Offering of the Consumers' Power Company

THE National City Company is offering $5,000,000 general and refunding mortgage ten-year 7 per cent gold bonds, Series A, of the Consumers' Power Company and $3,000,000 7 per cent serial gold debentures. The former are being offered to yield more than 7.28 per cent and the latter to yield about 7.75 per cent.

The bonds mature Jan. 1, 1930, and the debentures mature serially Feb. 1, 1922 to 1927, inclusive. The former are being offered to reimburse the company for the retirement of certain underlying bonds and capital expenditures previously made as well as to provide for future construction. The debentures are being sold to provide the company with a substantial working capital as well as to reimburse the treasury for the retirement of underlying issues.

Dr. Humphreys Heads Consulting Engineers

AT A MEETING of the Council of the American Institute of Consulting Engineers on Jan. 20, Dr. Alexander C. Humphreys, president of Stevens Institute of Technology, Hoboken, N. J., was chosen president; S. Whiery, consulting civil engineer, vice-president, and F. A. Molitor, secretary and treasurer.

Alexander Crombie Humphreys, who is of Scotch birth, was graduated in 1881 from the Stevens Institute

DR. A. C. HUMPHREYS

of Technology. His work was largely in gas engineering. He was senior member of the engineering firm of Humphreys & Glasgow, of London and New York, from 1892 until 1908, and in 1910 reorganized the New York firm as Humphreys & Miller. Dr. Humphreys became president of Stevens in 1902. Dr. Humphreys is widely known for his published articles on depreciation and engineering accountancy, appraisals and methods.

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Investment and Return.—In granting an increase in rates to the Washington Railway & Electric Company, the District of Columbia Public Utilities Commission announced its adherence to the opinion it had expressed before, that until conditions created by the war become more normal, rates for service which will yield a return of 6 per cent are reasonable and in no sense confiscatory.

Rate Differentials.—The Pennsylvania Public Service Commission has dismissed a complaint against an increase in rates for gas made by the Philadelphia Suburban Gas & Electric Company, in which the contention was made that lower rates for the larger consumers caused the smaller users to bear a greater burden than would be the case were all the gas sold at the same rate irrespective of the consumption together with a ready-to-serve charge. The commission said: "The practice of public service companies selling large quantities of gas, water and electricity at what might be termed 'wholesale' rates, whereby the unit of cost to the consumer is lessened, has long been recognized by both commissions and courts as being beneficial alike to the companies and all their consumers and does not constitute unjust discrimination."

Discrimination in Favor of Large Consumers.—The Wisconsin Railroad Commission has investigated the rates of the Coleman-Pound Light & Power Company on the complaint of stockholders. It developed that an illegal rate of 2 cents per kilowatt-hour on energy used for power purposes in a mill had been in force for four and one-half years before the rate was filed with the commission as applicable to all installations of 20 hp. or more, but no complaint had been made by other consumers. It was contended by officials of the utility that increasing the rate to the mill would result in the loss of this consumer. During the year ended June 30, 1919, the utility purchased 98,500 kw.-hr. at a net cost of $1,341.33. The mill used 45,270 kw.-hr. Excluding this amount, the consumption of all other consumers would not exceed the annual minimum of $1,200 provided for in the contract between the utility and the Wisconsin Public Service Company. For this reason it was held that the loss of the mill business would result in burdening the other consumers with that portion of this energy cost now carried by the mill. In its decision the commission said: "The fact that the utility has earned a fair return upon its reported value during the past four years with a low rate to the mill would indicate that with the rate applicable thereto increased, the rates to other consumers might be equitably lowered. If operating conditions were normal at this time, some adjustment would appear advisable in the rates for commercial service. In our opinion, however, in view of the uncertainty regarding further increases in the cost of electrical energy to the producing company, we should not be justified in reducing the rates in the commercial schedule. It is ordered that the Coleman-Pound Light & Power Company discontinue the power rate applicable to consumers having installations of 20 hp. or over and substitute therefor the following schedule: Minimum charge, 50 cents per month per horsepower of connected load; energy charge, 2½ cents per kw.-hr.

Protection from Competition.—The Mackay Light & Power Company having asked the Idaho Public Utilities Commission that the Ashton & St. Anthony Power Company be restrained from furnishing electric service to the municipality of Arco, a place within the territory allotted by the commission to the complainant company, the commission pointed out that the public utilities act was amended in 1917 so as specifically to exempt municipal corporations from the jurisdiction of the commission. The commission, however, went on to say: "The Ashton & St. Anthony Power Company, being a utility under the control of the commission, will not be permitted to invade the territory of a rival utility by hiding behind the law exempting municipal corporations from the jurisdiction of the commission. Further, the commission will not approve any provision by which the village of Arco may purchase from said defendant electrical energy in excess of the amount required for use within the corporate limits.

Theory of Rates.—In deferring decision on an application for increased rates made by a telephone company until such time as improvements contemplated by the company shall be completed, the Missouri Public Service Commission said: "The actual fair value of investment at the time used and useful in the business of furnishing service to the public is the true basis for calculating proper rates. Intent to increase the plant value through improvement, although partially completed, cannot be accepted by this commission as a basis for the purpose of fixing rates. The installation must be made and put into service at the disposal of the subscribers before the increased rates can be based thereon. Should the commission accept the expert testimony relating to proposed improvements or improvements in course of construction, offered as representing the value of the plant, as such rate-making basis, any company might file an application to increase rates, predicated upon the theory of what it intended to do at some future time."

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month.

New Mexico State Electrical Association.—The annual convention will be held at Albuquerque on Feb. 16, 17 and 18.

Oklahoma Utilities Association.—The annual convention will be held next week, Tuesday, Wednesday, and Thursday, at Oklahoma City.

Pittsfield Section, A. I. E. E.—On Feb. 19 a paper on "Thunder," by M. Humphrey, will be presented before this section of the Institute.

Electrical Supply Jobbers' Association.—The twelfth annual meeting of the Electrical Supply Jobbers' Association will be held at Del Monte, Cal., on May 12, 13 and 14.

Wisconsin Contractor-Dealers.—The next convention of the Wisconsin State Association of Electrical Contractors and Dealers will be held at the Republican House, Milwaukee, March 24 and 25. John A. Piepkorn, 108 Sycamore Street, Milwaukee, is secretary of the association.

American Physical Society.—A regular meeting of this society will be held in Fayerweather Hall, Columbia University, New York, on Saturday, Feb. 28, possibly with sessions also on Feb. 27 if the length of the program should make this necessary. The meeting next in order will be held at Washington on April 23 and 24.

Practical Demonstration of Way to Locate Faults in Feeders. — Methods of locating faults in underground and overhead distribution systems were explained at the Cleveland meeting of the transmission and distribution committee, Ohio Electric Light Association, by James Vahey, Boston, and C. N. Rakestraw, Cleveland, on Jan. 22. The methods were demonstrated by locating a faulty feeder in one of the Cleveland Electric Illuminating Company's substations and tracing the trouble to its source.

Empire State Gas and Electric Association.—The electric meter section of this association will meet in the McAlpin Hotel Annex, New York City, on Wednesday, Feb. 25, at 10 a.m., when papers will be presented as follows: "The Warren Master Clock," by D. P. Burleigh, General Electric Company; "Recent Instrument Developments," by R. T. Pierce, Westinghouse Electric & Manufacturing Company; "Demand Meter Maintenance Methods," by E. E. Hill, New York Edison Company; "Labor-Saving Methods for Meter Testing in the Laboratory and on Consumers' Premises," by E. A. LeFever, Buffalo General Electric Company.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

New Bond Issue for Southern California Company.—An issue of $7,500,000 general and refunding 6 per cent bonds, series of 1919, is being offered by the Southern California Edison Company at 96 and interest to yield more than 6.30 per cent.

Chinese and American Engineers Organize in Peking.—The Association of Chinese and American Engineers was recently formed in Peking with an initial membership of forty engineers, among them well known Americans. More than one-half of the important engineering positions in China are said to be held by Chinese educated in America.

Standard Gas & Electric Earnings.—H. M. Byllesby, president of the Standard Gas & Electric Company, reports the best year in its history with a net revenue of $2,960,896 and a balance, after interest, dividend and amortization charges, of $962,546. The utility, oil and other properties of the company are all in highly satisfactory condition, the president says.

A Rapidly Expanding Electric Utility.—The switchboard output of the Trumbull Public Service Company, operating in and around Warren, Ohio, for 1919 was about 72,000,000 kw.-hr., with a maximum demand of 22,500 kw., which compares with 5,693,426 kw.-hour, and 1,550 kw. seven years ago. The Trumbull company is a subsidiary of the Cities Service Company, operated by Henry L. Doherty & Company.

New Addition to Vancouver Station.—The British Columbia Electric Railway Company, Vancouver, B. C., has just put into operation the third unit in its Lake Buntzen No. 2 plant. This unit is of 13,500 hp. and is driven by Doble wheels operating under a 400-ft. head. The generator was built by the Canadian General Electric Company. The waterwheel and generator itself were installed previously, and now the pressure pipe has been installed and the unit placed in operation.

Electricity Dooms Dutch Windmills.—The windmills of Holland, which still follow the original pattern invented long before the discovery of America, are said to be rapidly disappearing to give place to steam and electric plants. Sometimes a whole group of these windmills disappear and one central electric station is built to furnish in regular measure the energy that formerly fluctuated according to the weather. When the windmills burn down as frequently happens, no one thinks longer of rebuilding them.

Interconnection Proves to Be a "Fifty-Fifty" Proposition.—Figures for the year ended June 30, 1919, show a total of 21,383,700 kw.-hr. interchanged over the circuits of the United Electric Light Company of Springfield, Mass., and the Turners Falls (Mass.) Power & Electric Company. A remarkable feature of this successful interconnection, of which a pictorial idea was given on page 343 of the ELECTRICAL WORLD for Feb. 7, is that the amount of energy sold by each company to the other is almost exactly half the total, the Turners Falls company selling 10,537,600 kw.-hr. to the United Electric and purchasing 10,846,100 kw.-hr. from it.

Standard American Export Practice Grows in Favor.—Under the auspices of the National Foreign Trade Council, nine foreign trade organizations of the United States recently held a conference to promote the standardization of export quotations and export practice. In a booklet issued as a result of this conference special emphasis is laid on the fact that misunderstandings can best be avoided if the seller will formulate a written statement of the general conditions under which his sales are to be made and will see that the foreign buyer possesses these terms of sale when considering a quotation. The items which may be included in such a statement deal with delivery, delays, partial shipments, shipping instructions, inspection, claims, damage and payment. If all contingencies are thus covered by carefully considered conditions of sale, the conferees maintain, disputes will largely be prevented.

Lease of Sierra & San Francisco Power Company Approved.—The Sierra & San Francisco Power Company was represented by its president, H. F. Jackson, and its attorney, Warren Gregory, in the hearing before the California Railroad Commission for approval of its lease for fifteen years to the Pacific Gas & Electric Company. The lease was desired in order that the Sierra & San Francisco company might obtain stronger financial backing. Mr. Gregory said that in September of last year the company found itself unable to dispose of $1,000,000 of first mortgage bonds authorized by the commission and in consequence it was increasingly difficult to make necessary extensions. The Sierra & San Francisco company claims a value of $17,500,000 for the property involved in the lease, the terms of which are as follows: Rental for the year ending Dec. 31, 1920, $50,000; rental for the year ending Dec. 31, 1921, $500,000; rental for the year ending Dec. 31, 1922, $100,000; rental for each of the remaining years covered by the lease, $150,000. In addition to selling electrical energy to the United Railroads and other consumers in San Francisco, the Sierra company distributes water for mining, agricultural, manufacturing and domestic purposes in Tuolumne County. The application was approved by the Railroad Commission.

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

One-Man Street Cars.—The United States Supreme Court holds, in the case of Sullivan vs. City of Shreveport, La., that an ordinance requiring every street car to be operated by a conductor and motorman, subject to penalty for violation, is presumed a lawful exercise of the police powers for public safety, and notwithstanding a contested claim for the safety of a one-man car, cannot be held unconstitutional, in the absence of a showing of a clear case of arbitrary conduct on the part of the local authorities. (40 S.C.R. 102.)

Eminent Domain.—The Supreme Court of North Carolina has declared that where a telegraph company constructed its line over lands in which plaintiff owned the fee, subject to a railroad company's easement for a right-of-way, plaintiff is entitled to a reasonable compensation for the additional burden, and in the absence of a showing as to the relations between the telegraph company and the railroad company, such compensation cannot be cut down on the theory that the railroad company might in the future appropriate the entire right-of-way and thus oust the telegraph company. (101 S. E. 390.)

Obligation of Employer Who Collects Sick Fund from Employees.—Where an employer deducts monthly a portion of employees' wages for the purpose of accumulating a fund with which to care for employees who become sick he holds the fund in trust for the contributing employees, according to the decision of the Court of Civil Appeals of Texas, and assumes no personal responsibility to an employee who falls ill other than a proper and faithful administration of the trust fund. In the absence of a hospital of his own or a custom of furnishing hospital service, he is bound to furnish such service only if there is an unexpended portion of the trust fund. (216 S. W. 674.)

Fixing Amount of Damages.—A verdict for personal injuries made upon the theory that plaintiff was entitled to a sum which properly invested would yield him an amount annually equal to his past or expectant wages during his life, leaving the principal undiminished at his death, was clearly excessive and erroneous, it is declared by the Supreme Court of Appeals of Virginia, because it left out of consideration the facts that the plaintiff's earning capacity, while lessened, was not wholly destroyed and that, he being forty-two years of age, his earnings from manual labor would naturally diminish as he grew older. (101 S. E. 415.)

Men of the Industry

Changes in Personnel and Position—Biographical Notes

Howard M. Turner, consulting engineer, Boston, and recently with the Turners Falls (Mass.) Power & Electric Company, has been appointed lecturer on water-power engineering at the Harvard Engineering School, Cambridge, Mass.

E. M. Carr, who was superintendent of the municipal electric lighting plant at Columbus, Ind., has resigned to accept a position as superintendent of the municipal plant at Logansport, Ind.

P. M. Downing, heretofore chief engineer of the Pacific Gas & Electric Company, has been elected vice-president and will be in charge of electrical operation for that company. Mr. Downing's professional career has been co-

P. M. DOWNING

extensive with the development of hydro-electric power in California. He was born in Newark, Mo., Nov. 27, 1873, but went to California with his parents at the age of four. After his preparatory schooling he entered Stanford University with the first class enrolled, Oct. 1, 1891, and was graduated in 1895. After two years' experience as dynamo tender and inspector of street-railway equipment, he entered the employ of the Blue Lakes Water Company, becoming operating superintendent of plant. This plant, established in 1897, was among the first hydro-electric installations in California. Mr. Downing subsequently has had long and valuable experience with several electric power companies in California as local manager and superintendent of substations and lines. Entering the service of the Pacific Gas & Electric Company, he became operating engineer and two years later was appointed engineer of operation and maintenance, his duties involving the construction of all high-voltage lines. As chief engineer of the electric department he has had charge of construction, operation and maintenance of all water systems, generating stations (both hydro-electric and steam), transmission and distribution lines, substations, street-railway and steam-heating distribution. He was a member of the inductive interference committee appointed by the California State Railroad Commission in 1913 to investigate and recommend remedial measures for reducing interferences to telephone circuits paralleling power circuits. He is a member of the American Institute of Electrical Engineers and is chairman of the engineering committee, Pacific Coast Section, National Electric Light Association.

J. C. Clark, associate professor of electrical engineering at Stanford University and last chairman of the San Francisco Section, A. I. E. E., is on his sabbatical year's leave and is doing special research work for the General Electric Company in San Francisco.

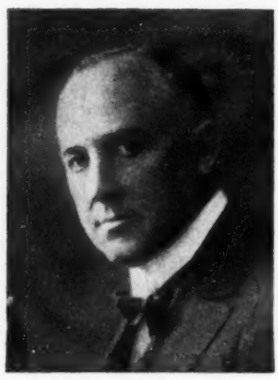
W. L. Davis, auditor of the Lehigh Valley Transit Company and affiliated companies, with offices at Allentown, Pa., has recently been appointed to the same position with the Lehigh Valley Light & Power Company and its affiliated companies. Mr. Davis will retain his connection with the railway company.

E. Steck has recently severed his connection with T. C. Keller, coal operator, Chicago, where he had charge of the design and installation of mechanical and electrical equipment in various coal mines, to join the engineering staff of C. A. Chapman, Inc., engineers and constructors at Chicago. Mr. Steck was graduated from the engineering department of the University of Michigan in 1901, and has been associated with the Western Electric Company in Chicago and Philadelphia, the Fort Wayne Electric Works at Fort Wayne, Ind., Dodge & Day, engineers of Philadelphia, and the Westinghouse Electric & Manufacturing Company in its Chicago office and as manager of its Duluth office.

Harold D. Sammis, since June 1913 connected with the California Railroad Commission in various capacities, has resigned to accept the secretaryship of the Public Service Commission of the State of Nevada. The resignation became effective Feb. 1.

William R. McCann, who was purchasing officer for the Emergency Fleet Corporation during the war, has become associated as electrical engineer with Stone & Webster, Inc., of Boston. Mr. McCann has had wide experience in the field of electrical engineering, first as designer for the Commonwealth Edison Company, Chicago, then as first assistant mechanical and electrical engineer on the construction of the Panama Canal, and later as valuation engineer of the Illinois State Public Utilities Commission at Springfield, Ill.

John B. Miller, chairman of the board of the Southern California Edison Company, has been appointed convention chairman of the National Electric Light Association, which is to meet at Pasadena, Cal., May 18 to 21, 1920. The long and useful activities of Mr. Miller in the electrical industry make this recent appointment on the part of President Ballard one of unusual promise. Mr. Miller was born in Port Huron, Mich., Oct. 23, 1869. In 1894 he went to southern California to engage in the amalgamation of a number of small light and power companies and in the development of water power for long-distance transmission. From this work have grown the great consolidated power activities of the



J. B. MILLER

Southern California Edison Company, of which he is now the head. Mr. Miller is connected with a number of other large business organizations, among them being the Pacific Mutual Life Insurance Company, and during the war period he was head of the Red Cross work for all national activities west of the Mississippi River. He is a member of a number of prominent clubs of the West, notably of the Pacific Union and the Bohemian Club in San Francisco and the Racquet and Tennis Club, New York City, as well as the Delta Kappa Epsilon college fraternity.

Obituary

Theodore B. Ford, formerly a member of the Connecticut Public Utilities Commission, died at his residence in Bridgeport, Conn., Feb. 2. He was born in Taunton, Mass., fifty-one years ago and had been prominent for many years in the engineering and contracting field.

William B. Starrett, assistant day manager of the American District Telegraph Company, Boston, died at Dedham, Mass., Feb. 2. He was fifty-eight years of age and was a native of Edgecomb, Me.

Trade and Market Conditions

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods

Transformer Purchases Tending Toward Standardized Types

THE value of transformer standardization is probably unrealized outside a few well-informed circles, but it is said on good authority that in the past year orders for standard distribution transformers have increased from 75 per cent of the total to 85 per cent, which means that special designs are called for in only 15 per cent of the sales, compared with 25 per cent a year ago. In other words, there has been a reduction of 40 per cent in about a year in the ratio of special transformer purchases to the whole. It should also be borne in mind that of the 15 per cent special orders a large proportion is scheduled for foreign trade, so that in the United States transformer standardization has attained a most satisfactory status, saving millions of dollars yearly to the electrical industry.

Acceptance of standard transformers has become so general that objections to doing away with special orders in cases where standard types will serve are seldom encountered. Insistence upon special equipment, or its specification on account of local necessities, may increase the cost to the purchaser from 5 per cent to 25 per cent or even more, according to conditions. Deliveries may be increased by twelve to fifteen weeks as against stock shipments in favorable cases. Standard transformers can be used in many cases where special units are first called for, but in the remaining 15 per cent of cases, representing the final purchase of specials, it is doubtful if much room exists for a change to the standards. Manufacturing costs are not at present seriously affected, speaking generally, by the special orders placed, whereas the entire industry is benefiting from the increased use of the standard units. Mass production is being realized, and the savings accomplished on standards have also been effective in reducing the cost of getting out specials.

The call for special transformers is on the whole independent of type and capacity and is confined chiefly to users of non-standard voltages. In the power transformer field standardization cannot accomplish as much as where the sales volume in commodity units is greater, but even here good results are being realized by adhering as far as practicable to established designs.

Market Virtually Bare of Conduits and Porcelain

AN EXTREMELY acute situation exists now in the wiring materials market, and while hope is held out for relief in the supply of pipe and boxes there is little expectation that the situation with regard to flexible conduits and porcelain will clear in the near future. Insulated wire is the one outstanding exception; the manufacturers, while well booked up on wire, are making good shipments and jobbers have plenty of No. 14.

Supplies of rigid conduit and outlet boxes in all hands are very low, and where they exist they are badly broken. Big building depends upon pipe for its electrical construction, and if that material is not available that building generally must stop. Little relief can be expected from open wiring because porcelain cleats are scarce, and although some large stocks of knobs have been reported, there are no nails with which to put them up. Loom, too, is very scarce. Little need be said of armored conductor. While there is a steadily flowing supply of this conductor, it is in such small quantity in comparison with the demand for it that as shipments come in, jobbers can do nothing but deal out a portion on each order at hand.

The steel mills are badly handicapped in their supplies. Car shortage has materially reduced deliveries to them of coal and coke and has held up their shipments of finished products so that their storage space in some cases is taxed to the limit. Recently much semi-finished steel in transit has been held up by snowstorms. Manufacturers expect, however, that the pipe and box situation will ease up with a clearing of traffic and should be in better shape in another month. The inability to produce more steel strip, on the other hand, with present capacity holds forth little hope for any betterment in the armored-conductor market until the demand subsides—or more capacity is installed.

Building reports almost without exception predict a large amount of building this spring and summer. Heavy buying of structural steel is reported from day to day. Rigid electrical installation is now badly handicapped by shortage of materials but a way for a certain distance out of the woods is shortly expected. It is apparent that building needs will not be satisfied unless production of the raw, semi-finished and finished materials now so badly lacking is stimulated in a marked degree.

Westinghouse Additions at Lester to Cost $5,000,000

NEW buildings and equipment to cost $5,000,000 will be put up at Lester, Pa., near Philadelphia, by the Westinghouse Electric & Manufacturing Company. Contracts for the construction have been let to Westinghouse, Church, Kerr & Company, who will start the work at once. An erecting shop, 130 ft. x 300 ft. with balcony; a machine shop for large work, 130 ft. x 750 ft. with balcony; a three-story warehouse, 40 ft. x 600 ft. and a one-story machine shop, 130 ft. x 500 ft., make up the buildings. It is believed the buildings will be ready for occupancy by July 15, 1920. When completed the entire plant will provide work for from 4,000 to 5,000 men, there being 3,000 men now employed.

Lists on Standard Porcelain Have Just Been Doubled

LIST price on standard porcelain, except tubes, have been doubled as of Feb. 10. The supply of wiring porcelain is not increasing at the present time, but it is stated by a prominent authority in the trade that there should be more of it available in the spring and early summer. Factory capacities are being increased so that by that time some of them will be able to turn out up to 50 per cent more than they can today. Labor conditions in the molding industry are such that only about 60 per cent of possible capacity is now being produced. Orders are being booked well into the second half of the year, while the quickest shipments that can be made on new orders are from four to five months.

Good Market Foreseen in Industrial Heating Units

The growth of industrial heating business, outside of its application to steel furnace work, throughout 1919 has been noticeable, having been estimated at $1,100,000. This is an increase of about 20 per cent over 1918 sales. Approximately $2,000,000 worth of control and equipment was sold for steel furnace work. The last four months of the year, however, show heavier business than the previous months. The application of electric heating in industrial

work is really so little utilized that an estimate of an increase of 20 to 25 per cent in 1920 would seem to be rather low. One manufacturer has only recently announced the discontinuance of production for stock of standard domestic heating appliances and the concentration from now on of his energies on industrial electric heating. He expects his 1920 industrial heating business to be three times his 1919 business.

Manufacturers are up to capacity on current orders and in some cases are a month behind in shipments. One month is a fair shipping schedule, with six weeks as a long shipment. Little stock is available.

Steel-furnace equipment takes a much longer shipping schedule, three months being required to fill orders for control and accessories for furnace capacities up to, say, 500 kva. On larger capacities the shipments are running up to four and five months.

The market for steel-furnace equipment was overbought in 1918, so that the demand was light in 1919. At the same time, an estimate for 1920 sales has been made, placing them 50 per cent over those of 1919. If sales in 1915 were represented by the unit 1, those in 1916 have been given as 2, while in 1917 they increased rapidly to 4. Over the 1918 war period they continued to 6, but in the next year, with steel demand slackened and little new electric steel-furnace work going on, sales dropped to 3. The 50 per cent estimated demand, therefore, would bring sales by the end of 1920 to the unit 4½. At the present time the demand is good and gives promise of meeting the estimate.

Should Schedule Material Lists Be Doubled?

SCHEDULE material prices advanced last week about 10 per cent. Supply jobbers in the East are in favor of the plan of doubling list prices, which was started last spring by the General Electric Company (ELECTRICAL WORLD, March 8, 1919), but manufacturers as a whole are not sold on this idea at the present time. Jobbers want to get away from the necessity of plus discounts, because, they claim, it carries confusion and mistakes in quoting and billing. The underlying idea of a discount is a subtraction and not an addition.

It is difficult to say right now what course manufacturers will take, but at present they are of an open mind. At least one manufacturer of schedule material has just issued a new catalog, and others are on the press and are about to be issued. Of course, it would be a simple matter for the manufacturers to mail out riders advertising that list prices had been doubled and that discounts would be changed in a certain ratio, were the plan adopted. The doubling of list prices would naturally have a psychological effect upon the ultimate consumer, although the ultimate consumer has little to do, as a rule, with list prices of this material. It is more often part of a wiring job or a component part of lighting fixtures and does not enter as a separate item.

Transformer Stocks Uneven in Very Active Market

VIGORORUS activity characterizes the transformer market, and manufacturers are maintaining with difficulty somewhat uneven stocks. Orders have been coming in steadily for the past three or four months, and production is just about keeping pace with deliveries. Distribution and power transformers are both in great demand. Labor is fairly plentiful, but there is a decided scarcity in insulating materials of the higher grade. On distribution transformers, roughly listed from 200 kva. downward, deliveries range from immediate shipments to about twenty weeks, factory stocks being rather spotty. Transformer steel is scarcely up to normal in supply; cast-iron radiators for self-cooling units are short, and there is a disturbing lack of fuel in some shops remote from the coal fields.

High wages and extremely costly raw materials are disquieting features of the situation from the manufacturer's standpoint. A severe shortage of the Egyptian yarn used in insulation now handicaps the maker of transformers. This long fibered, space-saving material is very hard to get even at $4.60 a pound, compared with a pre-war price of 80 cents. Some anxiety is being manifested as to the future supply of fiber, but the situation cannot be called serious as yet. Labor costs exert a constant upward pressure, accompanied by local readjustments or "rounding out" and particularly by increased office expenses to compensate for advances in shop wages. It is expected that transformer steel will cost more before long, and the upward tendency in copper costs is another factor which is putting a decided strain upon present transformer prices. These, by the way, are about 50 per cent above the pre-war level, but if prices had followed labor and material costs closely during the past six years the quotations of the day would easily exceed those of early 1914 by 100 per cent. Several factors have held transformer prices far below the advances recorded in other commodity markets. Unwillingness to profiteer on the part of the leading producers of electrical apparatus is one. Intensified effort to increase the efficiency of production is another. A third and very important factor is standardization. Without this last prices must have risen substantially beyond present figures.

Navy Department Has Surplus Cable and Accessories for Sale

MORE than $200,000,000 worth of equipment which has been declared surplus for navy needs, including large quantities of cable, copper wire and electrical accessories, is being offered for sale by the United States Navy. Virtually all of this material is new. Among the surplus material is approximately 2,000,000 ft. of cable, which the navy will sell at a fixed price. In addition there are 3,500 boxes of connection wire, 20 to 60, and 180,000 ft. of No. 14 duplex wire. Large quantities of electrical accessories at the various naval bases on the Atlantic Coast and the Great Lakes have also been declared surplus by the navy and are being offered for sale. Inquiry concerning the material may be made of Commander C. G. Peterson, director of the board of sales, division of supplies and accounts, United States Navy, Washington, D. C., and proposals for any part or all of this material will be received by sales boards at supply stations in New York, Philadelphia, Norfolk, Charleston, S. C., Boston and Great Lakes Naval Station.

Detailed description of some of the surplus material is as follows:

1,493,000 ft.	No. 14 duplex lighting and power cable.
61,000 ft.	No. 14 BX, two conductor commercial armored cable.
218,829 ft.	No. 14 BXL, two-conductor cable.
88,000 ft.	No. 14 BXL, four-conductor cable.
65,000 ft.	No. 14 duplex BX wire.
112,471 ft.	No. 14 duplex BX leaded wire.
100,000 ft.	No. 14 BX leaded four-conductor cable.
15,000 ft.	No. 18 BX, four-conductor commercial armored cable.
350,000	tungsten 40-watt and 60-watt lamps.
3,500	electric fans.
125,000	fuses, 6 amp. to 25 amp.
2,000	switches.

Two transformers, 100 kva., 2200-volt primary, 220-110-volt secondary, 60-cycle, single-phase. Specification 17-T-3 and Standardization Rules of the A I. I. E; manufactured by Westinghouse.

Much Hydro-Electrical Machinery Demanded Abroad

The great increase in the price of coal throughout the world has made fuel economy a most pressing problem. Reports reaching the National Foreign Trade Council denote a tremendous and continued opportunity for the American electrical manufacturing industry in supplying the needs of these countries which are now forced to develop their electrical power to the utmost.

Large railroad electrification projects are soon to be carried out in Italy and South America. In the former country 800,000,000 lire will be spent for electrification of 6,000 km. of railroads. Portugal will probably follow in Italy's footsteps. Many of the South American countries are studying this problem, and Bolivia has just declared as public domain the watersheds of the rivers having sufficient power for that purpose. Throughout Chile many power plants are being built.

In France a bill recently passed both houses and has become law for the canalization of the Rhône from Lake Geneva to the Mediterranean. The swiftnss of the current of this river will be modified by means of a series of locks and dams, the latter being utilized to generate electric energy and for irrigating purposes. Nineteen large generating stations are to be provided which will furnish electric energy rendering from 12,000 hp. to more than 70,000 hp. per station. It is estimated that the river is capable of generating energy equivalent to 760,000 hp. or 4,848,000 kw.-hr. annually, which is equal to a saving of nearly 500,000,000 tons of coal. Two hundred thousand kilowatts of the energy generated is reserved for the use of consumers in Paris at the price of 2 cents per kilowatt (locally generated energy now costs 10 cents). The remaining 560,000 hp. will be utilized by metallurgical, electrochemical and other industries in the Rhône Valley for electric traction on the Rhône, for the electrification of a portion of the Paris, Lyons & Mediterranean Railway, pumping irrigation water, etc. The cost is estimated at 2,000,500,000 francs

Metal Market Situation

THE copper market is quiet and really is rather strong. Producers are quoting nominally at 19.25 cents a pound for February and March delivery, but it is believed in the trade that this figure would be shaded one-eighth or one-quarter if any large order should present itself. The large ordering for the first quarter, however, has been completed, and part of the second quarter is booked.

The outside market is quoting around 18.62½ cents for nearby copper. Offers have been made by this market to sell large amounts at an attractive figure, but there is considerable doubt that the would-be seller had that amount. It seemed to be, rather, an attempt to pull down the market.

There is a better supply of lead available for February, and the demand is good. Future buying is being done with caution because of the prevailing prices. On Feb. 7 the American Smelting and Refining Company raised its lead quotation one-quarter cent to 8.75 cents a pound. This is the eighteenth consecutive advance that has taken place since its low price of 5 cents of last May.

Copper producers have apparently held to a conservative course in regard to prices. During the two months of December and January, when it is estimated 700,000,000 pounds of the red metal were sold, the price rose very little. Consequently, in the recurring cycle of activity and quiet in the market, it is expected that when the buying movement sets in again for second quarter and beyond, there will not be a big advance in price.

NEW YORK METAL MARKET PRICES

	Feb. 3	Feb. 9
Copper	£ s d	£ s d
London, standard spot	119 0 0	121 15 0
	Cents per Pound	Cents per Poun
Prime Lake	19.00 to 19.25	19.00
Electrolytic	18.50 to 18.75	18.50 to 18.62½
Casting	18.25	18.00
Wire base	22.25	22.25
Lead, trust price	8.50	8.75
Antimony	11.50	11.50
Nickel, ingot	43.00	43.00
Sheet zinc, f. o. b. smelter	12.50	12.50
Spelter, spot	9.20 to 9.30	9.00 to 9.10
Tin	59.25	58.00
Aluminum, 98 to 99 per cent	31.50 to 32.50	31.50 to 32.50

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire	17.75 to 18.00	17.00 to 17.50
Brass, heavy	10.00 to 10.50	10.00 to 10.50
Brass, light	9.00 to 9.50	9.00 to 9.50
Lead, heavy	7.00 to 7.25	6.87 to 7.12½
Zinc, old scrap	5.00 to 5.25	5.00 to 5.12½

THE WEEK
IN TRADE

WITH the exception of the Southern and Midwestern localities, the electrical jobbing business, and all business in general, has suffered greatly in the past week from the effect of epidemics of sickness and from snow. There has been a heavy diminution in the ranks of all classes of workers, while snows have tied up local as well as interstate traffic and transportation and have stopped for the time being much building construction. Jobbers' stocks are suffering from need of replenishment, and steel mills are suffering from the lack of coal and coke because of car shortages.

Particular shortages are found in all kinds of conduits, and premiums of as high as $30 per 1 000 ft. have been paid for pipe in New York City. Porcelain is extremely low and outlet boxes can be obtained only with difficulty. In the spring, however, it is expected that pipe and porcelain supplies will be better.

Building continues good in the South and West, and plans are going through in good shape. Collections are good.

Of the price advances in the last week the most important are in schedule material, attachment plugs and flexible armored conductor. List prices on standard porcelain have been doubled by at least one important producer.

NEW YORK

The jobbing trade is still suffering from the effects of the influenza epidemic and the cold weather, while heavy snows have added another burden. Over the latter part of last week transportation was almost entirely suspended. Little material came in to stocks and few deliveries were made. Much more or less exposed construction was stopped, thereby somewhat diminishing the demand for trucking. Clerical and sales forces are still depleted. In New York City the Mayor's ruling stopping other than necessary trucking on Monday further cut down deliveries in order to use trucks and men in snow removal. Shipping is badly tied up at piers.

Several price changes went into effect the first week of February, notably 10 per cent increases in schedule material and attachment plugs and an increase in flexible armored conductor of $5 per 1,000 ft. Premiums as high as $30 per 1,000 ft. are being paid to obtain pipe. The list prices of porcelain have been doubled.

Lighting Fixtures.—Under present heavy buying, shipments on the higher class fixtures are from two to three months. Shipments on glassware are much longer, running in some cases to June.

Heating Appliances.—Extreme shortage still exists, that of flatirons being especially acute. Heavy ordering for all the year's requirements shows that these appliances are no longer seasonal goods.

Fans.—Jobbers are ordering in good quantities.

Schedule Material.—A general price advance of approximately 10 per cent was effective Feb. 3 and 4. Announcements from manufacturers were dated back and no protection was granted as a general policy. Orders by wire under former prices were accepted by salesmen but returned by the manufacturer.

Attachment Plugs.—On Feb. 1 and 2 a price advance of about 10 per cent became effective.

Flexible Armored Conductor.—A price advance of about $5 per 1,000 ft. became effective Feb. 5. No relief in supply is expected until the output of steel strip can be increased or the demand for the finished conductor decreases. Several mills are on price at delivery basis.

Rigid Conduit.—Premiums up to $30 per 1,000 ft. have been paid to obtain shipments from some manufacturers'

warehouse stocks. The stocks, however, are very limited. In these cases jobbers' prices for ½-in. black pipe are around $110 to $115 for 1,000 ft. Jobbers' stocks are out in some cases.

Outlet Boxes.—Acute shortage exists but will be somewhat relieved when much raw material now held up in transit by snow conditions is permitted to reach the manufacturers. Better supply is expected in another month if weather conditions permit movement of raw materials and coke.

BOSTON

The New England electrical trade was greatly upset by last week's blizzard and is just emerging from the tie-up. The volume of trade was cut down 30 to 50 per cent. Many employees in all branches of the industry are ill. Deliveries are practically at a standstill with the exception of a moderate volume of local shipments within city limits. Collections were hard hit; one large jobber received no remittances for four days. Mail service was throttled by the storm. Much business, however, was done by telephone. Carloads of electrical freight were held dead in the yards and incoming and outgoing shipments are virtually shot to pieces. Prices are firm with a sweeping advance Monday of about 10 per cent on schedule material except fuse plugs. Stocks are very irregular, showing little change from last week. The enormous demand for motors cannot be filled short of three or four months. The January business of a representative jobber was double that of January of last year.

Oil Circuit Breakers.—There is a good movement as the result of central-station buying.

Wire.—Prices are steady. A substantial demand exists and there are reasonably good stocks.

Appliances.—Business was greatly curtailed by the storm. Jobbers' stocks of electric tableware are looking better. On Monday jobbers were almost overwhelmed by delayed mail orders.

CHICAGO

The volume of business handled by jobbers shows no signs of diminishing. Uncertainty of prices as well as of delivery is still the outstanding feature. A general advance of approximately 10 per cent was announced on Feb. 4 for all schedule material. In some cases prices have been withdrawn on rigid conduit, flexible armored conductor, flexible non-metallic conduit, flexible metallic conduit, outlet boxes and sectional switchboxes. Jobbers are buying this material where they can get it and at a price of delivery. Credit is good with collections at about forty days for January. This was an increase over December because of the volume of clean-up business of the last of the year. In January, 1918, collections were about fifty-three days. Lamp manufacturers report the largest volume of business ever recorded at this season of the year. It is not certain whether this is due to the actual demand or to overstocking by agents. The heating appliance trade in hot plates and ranges is particularly brisk. It is reported that range manufacturers will be sold out by May 1 if not before that time. The building up of the hot-plate trade has been partly because of the installation of hot plates in apartment buildings as a part of the standard equipment. East St. Louis is to have a two-million-dollar hotel. Building permits issued in Chicago for the week ended Feb. 7 amounted to $1,300,000. A number of projects of from $250,000 to $500,000 were initiated during the week.

Wire.—Prices on both rubber-covered and weatherproof remain the same as last week. Deliveries are fairly good in the standard sizes of code wire.

Furnaces.—Electric brass furnaces are moving in increasing number. The Booth Electric Furnace Company recently reported the sale of twenty of their rotating type in sizes ranging from 250 lb. to 2,000 lb.

Lamps.—Lamp deliveries are slow on all types and sizes but more especially on the common-standard lamps.

Cable.—Because of the shortage of steel tape parkway cable is hard to obtain in sizable orders. Deliveries at best are sixty to ninety days. Submarine steel armored cable is quoted on a five-month delivery basis. High-voltage cable, insulated with rubber or cambric, can be had on a ninety-day delivery. Prices are normal with no change reported since Dec. 1.

Farm-Lighting Sets.—Deliveries on Delco farm-lighting sets are being made out of stock to Middle Western dealers. The 750-watt size is quoted at $545 and the 3-kw. size at $1,620.

Lock-Nuts and Bushings.—Stocks are in fairly good shape on all sizes. The ½-in. lock-nut is quoted at $1 per 100 in lots of 5,000, and ½-in. bushing at $2.40 per 100 in lots of 5,000.

Schedule Material.—Stocks are somewhat spotty and deliveries are uncertain. A general advance of about 10 per cent has been announced, and conditions are rather unsettled in this class of material.

Hot Plates.—Two-burner hot plates are quoted at $34 list, with a discount of 25 per cent; three-burner plates at $45 less 25 per cent.

Ranges.—The Hughes No. 50 is quoted at $178 list with 25 per cent off. The demand for ranges has been excellent with every likelihood of manufacturers being sold out within a short time.

Heating Appliances.—Stocks of percolators, flatirons, etc., are being ordered in numerous cases for the next holiday season. Jobbers do not expect to be limited in their business by small stocks, as they were this last season. There is also a strong demand for water heaters.

ATLANTA

The recent increase in the price of materials apparently has not served to check any building operations either under way or projected. Despite the difficulty of obtaining lumber, brick and other building materials, the permits for Atlanta for January totaled $1,750,000. Some observers are predicting that many of the building operations as projected cannot be carried through on schedule time as the inability to obtain the necessary materials will act as an automatic check. Larger contractors are reporting the labor situation somewhat easier than has been the case for a number of months past, probably owing in no small measure to the difficulty in obtaining building material.

With the end of the oil-mill season at hand, a number of oil mills adjacent to hydro-electric lines throughout the section are taking steps to change over their mills from mechanical to electric drive.

General business conditions throughout the territory continue bright, and collections are reported unusually good. Jobbers report difficulty in obtaining all lines of material that depend upon the supply of raw steel products.

Wire.—There is an improvement in the wire situation throughout the territory. Very fair stocks of both rubber-covered and weatherproof are reported by jobbers, the only scarcity being reported in weatherproof, sizes Nos. 6, 8 and 10. The demand continues brisk while fair shipments are reported. Prices remain steady, rubber-covered being quoted at 28 cents base and weatherproof at 29 cents base.

Schedule Material.—A general price increase in schedule material of approximately 12½ per cent to 15 per cent is announced. With the exception of porcelain, stocks throughout the territory are reported fair, with shipments coming through within reasonably short periods.

Stamped Steel Boxes.—Prices to jobbers on this article were withdrawn Feb. 4. Stocks in the territory are reported very poor in the face of a brisk demand and poor shipments.

Vacuum Cleaners.—A price increase of 7 per cent has been announced. The brisk demand will rapidly deplete the present good stocks, however, unless shipments show some improvement.

Renewable Fuses.—Jobbers report a growing popularity of all sizes of renewable fuses. The prospect is that fair stocks will be maintained on account of comparatively good

shipments. Stocks of plug fuses, however, are reported low. Prices, plug fuses, lots of 100 to 500, up to 30 amp., 6.3 cents each.

Lamps.—The peak of the winter demand for lamps has been reached without any serious shortage having been experienced. The type C lamps, including white Mazdas, continue to grow in popularity. Stocks and shipments throughout the territory are reported to be in satisfactory shape.

Conduit.—There is little or no change in the conduit situation. The outlook for any improvement in the present situation in the very near future is rather poor. Prices quoted, if in stock, in lots less than 2,500 lb., black, ½-in., $8.72; 1-in., $11.57; 1½-in., $27.67; galvanized, ½-in., $9.23; 1-in., $12.26; 1½-in., $29.32.

Dry Batteries.—Unusually brick demands continue. Local stocks are reported in fair shape but shipments are reported somewhat slow. Jobbers' prices are: For 12 to 49, $41 per 100; 50 to 124, $38 per 100; more than 125, $35 per 100.

SEATTLE-PORTLAND

A noticeable increase in demand for schedule material, particularly for residence construction, has been reported by both jobbers and dealers during the past week. The sale of domestic appliances has been a little lighter because of the decrease in general shopping as a result of the outbreak of influenza in the city. Jobbing houses are experiencing considerable difficulty in obtaining certain materials, and a feeling of uneasiness exists regarding a continued supply of necessary commodities. This applies particularly to domestic appliances, house-wiring devices and fractional sizes of motors. It is believed that this condition will be maintained for at least six weeks or more, when it is expected business will witness the peak. Every effort is being made to accumulate sufficient stocks to supply, in a measure at least, the anticipated spring demand. Orders are being placed months in advance. Deliveries are lengthening. Prices, with but few exceptions, show no change.

Spokane jobbers and dealers report business fairly active. Retailers are busy with clearance sales. Collections are good. Stocks are low. Portland district states that wholesale and retail trade is good and collections are fair. Demand for woodworking machinery is strong. Throughout the entire Northwest each week brings announcements of increasing residence construction. This condition is not confined to the large cities but is prevalent throughout the smaller towns in the district. In Hoquiam, Wash., a syndicate has been formed which will erect sixty modern homes at once. Bond, Ore., reports unprecedented activity in both residence and business building, as do many other towns of this size in both Oregon and Washington. Plans have matured for the erection of a hundred-room hotel in Port Angeles, Washington and plans for several large buildings, including a hotel and an apartment house, have been announced for Everett, Wash. The Commission of Public Docks, Portland, will shortly call for bids for electric wiring of a nine hundred foot section of the St. John's terminals.

Bells and Buzzers.—An increasing amount of residence building has caused a jump in price of these commodities, and sales have increased heavily. Local stocks are low and immediate replenishment is necessary if demands are to be filled.

Industrial Motors.—The demand shows a noticeable increase, the largest orders coming from out of town for use, principally, in fruit and vegetable canneries, shingle and planing mills and box factories. Authorities believe that this year's business in fractional-size motors will equal if not exceed last year's volume. The majority of jobbers report stocks in fair shape and shipments coming through in sufficient volume to care for the trade. Prices show no recent advance.

Sewing Machines.—The vibrating style of portable sewing machine is now quoted at $62 and the rotary style, full-head motor, at $74. Stocks are sufficient to care for the demand which is showing no noticeable increase.

SAN FRANCISCO

Building permit figures for the month of January for the principal Coast cities amounted to $6,370,000, as against $1,566,000 a year ago. All classes of construction are in good demand.

Tools.—Labor and steel costs have advanced the prices on hand tools considerably. Buffalo grips have advanced from 33⅓ to 50 per cent, and Klein pliers increased from 25 to 40 per cent. Deliveries are still very unsatisfactory, for orders are shipped in such small lots that a continuous shortage results. Heavier line tools, such as pike poles and shovels, are stocked in fairly large quantities. The demand is conservatively figured to have increased 100 per cent over last year's demands, partly owing to new construction and partly to several disastrous windstorms which necessitated considerable reconstruction.

Fixtures.—The demand continues good, although a strike, still unsettled, has caused orders to dam up. Unit fixtures are selling well or poorly according to the type of fixture concerned.

Wire.—Rubber-covered wire is again jumping, now selling in 5,000-ft. assorted lots at a 5 per cent advance over previous prices, making the cost of No. 14 $12.80 per 1,000 f.o.b. Coast points. Circular-mil cable has advanced from 10 to 15 per cent. During the year several jobbing firms increased their rubber-covered-wire service on such varieties as big circular-mil cables and lead-covered sheathing in 600-volt sizes. There has not been a great deal of movement reported yet because the demand for special stuff has been temporarily slow.

Heating Material.—A considerable advance, making standard irons list of $7.25 and toasters for $8.50, has been unfavorably received by the electrical dealers and in their opinion has hastened the time when advancing costs will be counterbalanced by decreasing demand. Up to date the increases have not hurt business but have been overcome by the new merchandising spirit on the part of dealers.

Ironing Machines.—After several years deliveries are steady and good outstanding contracts provide a steady demand. These contracts will be shortly increased from twelve to twenty-five lots, the twelve-lot contract having already fulfilled its purpose.

Ordnance Department Has Electrical Material For Sale

THE Ordnance Department of the United States Army offers for immediate delivery, open for inspection at any time subject to prior sale, the following factory equipment located at the United States Government Warehouse No. 188, Springfield, Mass.:

Four Maris Brothers single-beam bridge cranes, 16-ft. span, 1,000-lb. capacity, 220-volt, direct current.
One 100-kw. Sprague generator, 125-volt, direct current, 500 r.p.m.
Two 25-kw., G. E. generators, 110-volt, direct current, 675 r.p.m.
Twelve Westinghouse motors, from 1 hp. to 50-hp., 440-volt, three-phase, 60-cycle, type C.S., 900 and 1200 r.p.m.
Two Westinghouse motors, 3-hp., 220-volt, three-phase, 60-cycle, type C. S., 900 r.p.m.
Two Lincoln motors, 5-hp., 220-volt, three-phase, 60-cycle, 1200 r.p.m.
Sixteen twelve-circuit, three-wire power panels, 600-volts, slate mounted.
One ten circuit, three-wire power panel, 600-volts, slate mounted.

The Bridgeport District Salvage Board in Bridgeport, Conn., will receive all communications regarding the purchase of the following Mazda lamps, which are at the plant of the Colt's Patent Fire Arms Manufacturing Company, Hartford, Conn.:

100 25-watt lamps, 2,000 40-watt lamps, 700 50-watt lamps, 5,000 60-watt lamps, 144 150-watt lamps, 240 300-watt lamps, 500 500-watt lamps.

NEW APPARATUS & APPLIANCES

A Record of Latest Developments
and Improvements in Manufacturers' Products
Used in the Electrical Field

Electrically Lighted Transparency Frame

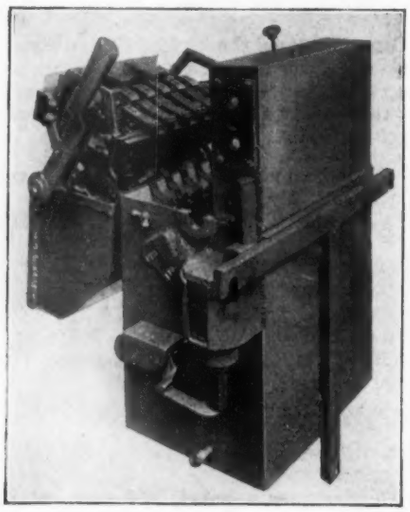
An indoor electrical advertising fixture consisting of a Circassian walnut frame 5 ft. 3 in. long and 1 ft. 7 in. high, holding five interchangeable transparent glass sides which are illuminated by two 2.5-watt lamps, is being manufactured by the National Retailers' Advertising Corporation, Kansas City, Mo. An adjustable flasher is incorporated in this unit, which is known as the "Gritt electrical fixture." It comes complete with 10 ft. of cord ready to attach to any lamp socket.

Two-Pole, Double-Throw Snap Switch

A double-throw, double-pole indicating snap switch, rated at 20 amp., 250 volts, has been perfected by the General Electric Company, Schenectady, N. Y. The switch is designed to answer the purpose of the double-throw, double-pole knife switch, but combines also the features of being inclosed and indicating.

Starting Compensator with Safety Features

An automatic low-voltage release and two series inverse-time-limit overload relays are incorporated in the design of the compensators made by



MECHANISM EASILY LIFTED OUT FOR INSPECTION

the Lincoln Electric Company, Cleveland, Ohio. The overload relays are adjustable to trip at any current and are designed to protect against overload and single-phase operation. The inside mechanism of the compensator, which operates in oil, can be removed by taking out a few screws and can be laid back in the swinging top of the case for inspection and repairs. By changing three connections the starting torque of the motor can be varied. It is stated that a decided jerk must be put on the handle to move it from one position to another, thus preventing arcing of the contacts.

Theater Projector Lamp for Alternating or Direct Current

Two theater projector lamps have been developed by the Brenkert Light Projection Company, Detroit, Mich.

MAY BE OPERATED FROM THE SWITCHBOARD

One of these, the arc type, is of 40-amp. rating for either alternating or direct current and uses a ⅜-in. carbon. This type may be operated for either "spot" or "flood" effects. The incandescent type uses a 1000-watt tungsten lamp and is designed for flood illumination.

Cushion Spring Lamp Guard Prevents Lamp Breakage

A cushion spring inside the guard holding the bulb in the center and preventing it from coming in contact with the outer wires of the guard is a feature of a line of steel lamp guards manufactured by the Frank W. Morse Company, 289 Congress Street, Boston. This guard comes in several types for 40-watt, 60-watt and 100-watt lamps. The joints are electric welded and the guards are electroplated in copper or silver.

One-Piece Brass Bracket Makes Assembling Easy

A bracket made of one piece of solid brass is being put on the market by the

ONE PIECE OF SOLID BRASS

Peerless Light Company, Chicago, Ill. This bracket is designed to eliminate the assembling of a number of separate pieces.

Electrically Driven Tire Inflator for Garage Use

For bracket mounting in small vulcanizing shops and small garages, for the purpose of direct tire inflation, a motor-driven air compressor has been developed by the Brunner Manufacturing Company, Utica, N. Y. The motor is rated at ¼ hp., and the net weight of the entire outfit is 9 lb. The outfit is not to be used with a tank storage system. For precipitating moisture a small cast-iron chamber is employed. The makers state that the pump will inflate a 35 in. x 4½ in. tire to 90 lb. pressure in four minutes.

Alternating-Current Wattmeter of Small Size

To correspond to the small direct-current meters which the Roller-Smith Company, New York, N. Y., has had on the market for several years, two alternating-current instruments of the same type and dimensions are now being made. An alternating-current

ALTERNATING WATTMETER IS FOUR INCHES IN DIAMETER

and direct-current wattmeter and an alternating-current voltmeter are the two types which have been developed in this 4-in. size. This line of meters is known as the "Imp" line.

Meter for Measuring Long Wave-Lengths

The Clapp-Eastham Company, Cambridge, Mass., has developed a compact portable wavemeter. It is mounted in an oak box, 5¾ in. x 8¼ in. x 6½ in.,

MEASURING WAVE LENGTH OF 150 TO 2,000 METERS

and weighing, complete, 5 lb. A small compartment in the box holds two inductance windings which may be attached to the meter. When the buzzer is operated the meter emits waves of known length.

Gas Temperature Reduced in Multiple 600-Volt Fuse

Gases formed by the blowing of the fuse and expelled through a metallic washer are reduced to a a low temperature before reaching the atmosphere, it is claimed by the makers of the "Atlas Four-in-One" 600-volt fuse. A system of maintenance providing for the exchange of a new fuse for an old one is operated by the Multiple Electric Products Company, New York City, which manufactures this fuse. The underwriters have approved the fuse in capacities up to 30 amp.

Rocker-Type Washing Machine with Demountable Tub

A rocker-type electric washing machine with a demountable and removable tub is announced by the Wayne Manufacturing Company, St. Louis, Mo. The machine will be known as the "Wayne No. 100." A swinging wringer, oilless bearings, a steel welded framework and japanned panels of sheet steel are other features to which the manufacturer calls attention.

Adjustable Oscillating Fan Mechanism

The Dayton Fan & Motor Company, Dayton, Ohio, have announced a new oscillating mechanism for desk fans. Features of this mechanism are compact worm and gear construction, wood thrust bearings and an adjustable crank. This crank is designed to hold the fan stationary or to swing it through several different angles. This new mechanism will be fitted to all "Dayton" oscillator fans of 12 in. and over.

Gasoline-Engine-Driven Generating Set

Four-cylinder, four-cycle gasoline engines of the automobile type, equipped with standard magnetos, carburetors, water pumps, tubular type radiators and fans, furnish the power for the gasoline-engine-driven generating sets manufactured by the Allis-Chalmers Manufacturing Company, Milwaukee, Wis. Governors regulate the speed to within 4 per cent from no load to full load, it is said, and the compound motors are designed to allow voltage variation of not more than 2 per cent. The sets are made in 5-kw. and 15-kw. sizes for 110 volts or 220 volts. They are designed not only for farmers but for contractors, warehouses, etc.

Interchangeable Threadless Pipe Fittings

A line of pipe-frame structural fittings and devices for supporting high-tension and low-tension wires and cables is being brought out by the Erie

FITTINGS ARE INTERCHANGEABLE FOR HIGH- AND LOW-TENSION WIRES

Electrical Equipment Company, Inc., Youngstown, Pa. The interchangeability of parts of the fittings is a special feature to which the manufacturers wish to draw attention. These fittings are made of malleable iron.

Radio Transformer for Experimental Use

An experimental radio-transformer combining a six-turn 8¾-in. coil and fifteen-turn 7-in. coil, mounted so that the latter slides freely inside the former, has been developed by the International Radio Telegraph Company, 326 Broadway, New York City, N. Y.

The total inductances are 8 millihenries and 44 millihenries respectively. The windings may be employed separately as fixed or variable inductances or in series for use on the variometer principle. Full-size calibration curves are furnished for each coil. The transformer weighs 10 lb. and measures, boxed, 12 in. x 12 in. x 15 in.

Small Storage-Battery Charger Requires No Oil or Grease

For charging small storage batteries, particularly used on automobiles, the "Rectigon battery charger" has been developed by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa. The design embraces no moving parts and, the makers claim, requires no oil nor grease. All parts are mounted on a circular cast-iron base and covered with a pressed-steel

CHARGER IS ATTACHED TO LIGHTING CIRCUIT

cover, which is shaped into a handle for easy carrying. The alternating-current leads are provided with a separable attachment plug and the direct-current leads with convenient clips for connecting to the battery. The charger is designed to connect to a 110-volt circuit and for use on batteries of three or six cells rated at 6 volts to 15 volts. It is made in two sizes to give charging currents of 1.5 amp. to 3 amp. and 3 amp. to 6 amp. respectively and weighing 9¼ lb. and 21 lb.

Pull-Chain Lamp-Socket Light Controller

The pull-chain shade-holder lamp-socket light controller made by the Anylite Electric Company of Fort Wayne, Ind., has been improved by making use of the "Uno Thread," which has been adopted by many other socket manufacturers.

Notes on Recent Appliances

Universal Fan

An 8-in. fan with a series, universal type of motor has been developed by the Robbins & Myers Company, Springfield, Ohio.

Motor-Driven Hand Sander

The American Floor Surfacing Machine Company, 518 South St. Clair Street, Toledo, Ohio, has developed a motor driven sander for removing shipping marks from boxes and for resurfacing wood surfaces.

MANUFACTURERS' ACTIVITIES

Record of Changes Affecting Sales and Distribution Together with Trade Personals and Notes on Foreign Trade, Jobbers' News and New Trade Literature

THE WEBER ELECTRIC COMPANY, Schenectady, N. Y., has just made the announcement of a capital increase from $25,000 to $100,000.

THE HUGHES ELECTRICAL CORPORATION, Syracuse, N. Y., has increased its capital from $25,000 to $100,000, to provide for general business expansion. Notice of the increase has been filed with the Secretary of State.

THE STROMBERG ELECTRIC COMPANY, Chicago, has purchased a site, 628 ft. x 295 ft., from the Consumers' Company and will erect a factory building, 220 ft. x 200 ft., at a cost of approximately $160,000.

ARTHUR ELLIOT ALLEN has been appointed district manager at New York for the Westinghouse Electric & Manufacturing Company to succeed Edward D. Kilburn, who has been elected vice-president and general manager of the Westinghouse Electric International Company. Mr. Allen is a native of Toronto, Canada, and received his education in England and also in this country. In June, 1902 he entered the employ of the Westinghouse Company at its Newark works, subsequently being placed in charge of the test department, where he remained until 1910. In that year Mr. Allen was loaned to the International Electric Protection Company, for which company he acted as chief engineer. In 1911, having completed that temporary work he returned to the Westinghouse company, being assigned to the supply division of the New York sales office. On Dec. 1, 1915, Mr. Allen was appointed manager of the supply division of the New York office, which position he retained until he joined the Canadian Overseas Forces as a private in October 1917. Later he went overseas as a technical officer in the Royal Flying Corps. After being honorably discharged from the army Mr. Allen returned to the New York office of the Westinghouse company as executive assistant to the manager, from which position he was promoted to manager.

A. E. ALLEN

THE H. R. WORTHINGTON COMPANY, Harrison, N. J., manufacturer of pumps, is rushing work on the construction of its three new additions. The structures will be each two-story, 50 ft. x 137 ft., steel and reinforced concrete, and will cost about $100,000.

LORENZO H. PIKE, formerly factory manager of the Hygrade Lamp Company, Salem, Mass., has resigned to join the banking house of H. V. Green Company, Salem. Walter Melvin, formerly of the Franklin lamp factory at Hartford, Conn., has succeeded Mr. Pike.

THE McPHILBEN LIGHTING FIXTURE COMPANY, INC., 264 Fulton Street, Brooklyn, N. Y., is having plans prepared for the construction of a new plant on property, about 56 ft. x 114 ft., recently acquired in Jamaica, L. I.

THE ARNESSEN ELECTRIC COMPANY, INC., 109 Broad Street, New York City, announces that after Jan. 15 its factory, warehouse and main office will be in its new building at 118 Hamilton Avenue, running through to 17-19 Rapelye Street, New York City.

THE DELTA ELECTRIC COMPANY, Marion, Ind., has added more than 24,000 sq. ft. of space to its factory. This company is now turning out about 250,000 dry batteries per month for use in its flashlights, lanterns, bicycle and vehicle lights and spotlights. The company estimates that within a few months the output of No. 6 batteries alone will amount to 250,000 per month.

FAIRBANKS, MORSE & COMPANY, Chicago, one of the oldest electrical corporations in the city, is changing from a closed to an open corporation. The company is issuing 325,000 shares, no par value, against $20,000,000 of assets.

THE WACLARK WIRE COMPANY has sold its plant in Elizabeth, N. J., to the American Copper Products Company, a Delaware company capitalized at $14,000,000. Besides manufacturing various wire products the Waclark company operates a brass mill.

UNIVERSAL BATTERY SERVICE COMPANY, CHICAGO, ILL., has been ordered by the Federal Trade Commission to drop the word Universal from its name, in connection with the manufacture or sale of storage batteries, because of the similiarity of the former name to that of the Universal Battery Company, Chicago, Ill. The claim of confusion among purchasers and misleading of the public was upheld by the Commissioner.

THE ESTATE STOVE COMPANY, Hamilton, Ohio, will speed up production and sales of Estate electric ranges this season. E. I. Williams will continue in charge of sales, but associated with him this year are three men who have served several years with public utilities and who will sell ranges from the standpoint of the central-station man. George E. Dunn, who, since 1914, has been in charge of the retail merchandise sales of the Public Service Company of Northern Illinois, with jurisdiction over that company's twenty-six salesrooms; C. E. Bougher, who has had charge of retail sales in Oak Park, Ill., and H. W. Lippert, from the New York Edison Company, form the new staff.

THE TEN FOOT-CANDLE CLUB FORMED.—The Sunbeam lighting specialists with the Western Electric Company, stationed in the various houses throughout the country, have organized the Ten Foot-Candle Club to co-operate with associations such as the Illuminating Engineering Society, in the campaign to promote the use of higher intensities in the illumination of factories and mills. The club has adopted as its slogan "Devoted to the promotion of adequate illumination properly diffused and without glare." There are no dues and no officers except T. J. Rider, Jr., of the Chicago Sunbeam Office. Mr. Rider founded the club, and signs himself "Lumen." The club has its own stationery, on which the foot-candle meter forming the most conspicuous part of the design and which contains a list of charter members.

THE ELECTRIC HOIST MANUFACTURERS' ASSOCIATION, New York City, announces that at a meeting on Jan. 23 it engaged the services of E. Donald Tolles as executive secretary. The office of the association hereafter will be at 52 Broadway, New York City. C. W. Beaver of the Yale & Towne Manufacturing Company, is the president, and R. H. McCredy, of the Shepard Electric Crane & Hoist Company, is secretary-treasurer. The next meeting of the association is scheduled to be held on Feb. 20, at 9 East Fortieth Street, New York City.

NEW SECRETARY OF NEW YORK ELECTRICAL CREDIT ASSOCIATION.—Franz Neilson resigned as secretary of the New York Electrical Credit Association about the middle of January. Fourteen years and eleven months have slipped by since Burt Ellis, Al. DeVeau, Clarence Sibley, H. R. Swartz, G. E. Pingree and R. B. Coney, then directors, appointed Mr. Neilson to the management of association affairs under their supervision, and in this time the membership has grown from 70 to 155. At the present time a membership drive is under way. The newly elected secretary is E. Donald Tolles, 52 Broadway, New York City, who is by no means a newcomer in the electrical industry and for whom association work is not a new field. After a business career extending over several years, he became associated with Franz Neilson in managing a number of open-price societies and trade associations, among others the association of which he has just been elected secretary. About four years ago, and after seven years' connection with Mr. Neilson and his various associations, Mr. Tolles became secretary of the Atlantic division of the Electrical Supply Jobbers' Association and first assistant to the general secretary, Franklin Overbagh. In this position, he has become known to a large number of both manufacturers and jobbers throughout the United States. During the war he was active in Washington in the interest of the industry, particularly in looking after the interests of the jobbers, and assisted in drafting "Circular No. 23," which provided for the certification of electrical supply jobbers. Mr. Tolles is a graduate of Amherst College and received the degree of Bachelor of Science in 1899. He is an active member of the New York State Bar.

E. DONALD TOLLES

THE WILKES-BARRE WILLYS LIGHT COMPANY has made application for a charter to the Commonwealth of Pennsylvania for a new corporation at Wilkes-Barre, Pa. This company will act as distributors for Willys light plants and accessories in northeastern Pennsylvania and northern New Jersey and in that territory will handle the product locally. The officers of the new corporation are: President, Harold N. Rust; treasurer, George E. Shepherd; vice-president and general manager, Harley C. Wheaton. Mr. Shepherd and Mr. Rust have been in the trade for more than twenty years, being associated in the electrical business in Wilkes-Barre under the name of the Shepherd-Rust Company.

AETNA ELECTRIC APPLIANCE COMPANY ORGANIZED.—The Aetna Electric Appliance Company has been incorporated under the laws of Maine to manufacture and sell industrial and domestic heating appliances. The headquarters of the company are at Boston, and the controlling interests include Walter S. Wyman, general manager Central Maine Power Company and Adironack Electric Power Company, Augusta, Me.; Ralph J. Patterson, resident manager Twin State Gas & Electric Company, Berlin, N. H.; George M. Patterson, Penobscot Bay Electric Company, Belfast, Me.; Dexter H. Spaulding, commercial manager Central Maine Powr Company, and A. L. Smith, Jr., Boston. The company is just putting on the market a new electric water heater for tank service.

THE ACME ELECTRIC & MACHINE COMPANY, Cleveland, Ohio, has recently increased its capitalization to $150,000 and is bringing out a line of electrical machinery. C. H. Bunch, chief engineer of the Electric Products Company, Cleveland, Ohio, has resigned that office, and is now connected with the Acme company as secretary and engineer. The new equipment to be manufactured is a complete line of battery-charging equipment and switchboards, together with a small low-voltage generator for farm-lighting trade.

ELECTRICAL SHOWS FOR CENTRAL OHIO.—Plans for the Central Ohio Electrical Show, to be given at Memorial Hall, Columbus, early in April, were outlined at a recent meeting of the joint committee representing the Columbus Electrical Contractors and Dealers' Association and the electrical department of the Ohio State University. One of the features of the exposition will be a display of electrical devices for house lighting.

BARCLAY PARSONS & KLAPP, engineers, 60 Wall Street, New York City, announce the change of the firm name to Parsons, Klapp, Brinckerhoff & Douglas. The personnel remains unchanged, consisting of William Barclay Parsons, Eugene Klapp, Henry M. Brinckerhoff and W. J. Douglas.

EXCEPTIONALLY LARGE MILL MOTOR FOR JAPAN. — The Westinghouse Electric & Manufacturing Company announces that it has received an order to furnish to the Imperiad Steel Works of Japan a motor of double-unit reversing slabbing-mill type of 5,800 hp. continuous capacity and 17,600 hp. momentary capacity. Among the accessories combined in this order the company will furnish a motor-generator set, the motor of which will be of 6,250 hp. capacity, three-phase, 25-cycle, and the two generators of which will be of 3,000 kw. capacity each, furnishing direct current at 700 volts to the slabbing-mill motor. A 150,000-lb. cast-steel flywheel is to be used with this set. Other apparatus will consist of exciter set, blower set, air washer, transformer, pumps, etc.

THE AUTOMATIC ELECTRIC WASHER COMPANY, Newton, Iowa, is commencing work on an addition to its factory to cost $135,000, in which it is proposed to produce the new cylinder-type Automatic family washing machine. The addition will represent an increase of 100 per cent in floor space of the Automatic factory.

JOHN E. HUBBELL, counselor-a-law, formerly of Chambers & Hubbell, Philadelphia, has opened offices at 469 Fifth Avenue, New York City, where his practice will be devoted exclusively to patent and trademark matters.

THE ROLLER-SMITH COMPANY, 223 Broadway, New York City, announces the appointment of Walter W. Gaskill, 141 Milk Street, Boston, as its agent for Boston and vicinity and other parts of the New England territory. Mr. Gaskill will supersede the P. I. Perkins Company, which represented the Roller-Smith Company in the said territory prior to the first of this year. Mr. Gaskill was graduated from Harvard and from there went in 1909 to the General Electric Company in its Schnectady works. In January, 1911, he became connected with the Boston office of that company, where he remained until June, 1918, as a specialist in electrical apparatus for pulp and paper mill work. From June, 1918, until April, 1919, he was in Washington with the Bureau of Aircraft Production, his particular work being in connection with the development and production of mobile lighting outfits for the illumination of aviation fields for night flying. Mr. Gaskill will handle, in addition to the Roller-Smith lines, the products of the Ward-Leonard Electric Company, Mount Vernon, N. Y., and the Brown Instrument Company, Philadelphia, Pa.

Supply Jobbers' Notes

CHARLES FELKER, who was manager of country sales for the Central Electric Company, Chicago, has resigned to become sales manager of Sworts Brothers, electrical jobbers, Rockford, Ill.

THE GULF STATES ELECTRIC COMPANY, New Orleans, La., announces its establishment as a new jobbing company. This firm will be open for business on Feb. 1, with George Wygant, formerly manager of the Stone & Webster properties at Baton Rouge, as president and general manager of the company.

Foreign Trade Notes

GREAT BRITAIN MAY PROTECT DOMESTIC ELECTRICAL IGNITION INDUSTRY.—The manufacture of electrical supplies and apparatus in Great Britain received a great impetus during the war, according to a bulletin on the "Economic Position of the United Kingdom, 1912 to 1918," just issued by the Department of Commerce. Although the British output of electrical goods before the war was large, exports considerably exceeding imports, the United Kingdom was dependent on Germany for magnetos and other essential accessories. In 1914 only one firm in England, according to the report, was producing magnetos, and the output of this plant in 1913-1914 was only 1140 magnetos of a simple type. There are now fourteen establishments turning out magnetos at the rate of 130,000 a year. Similarly, in 1914 there were only three firms producing ignition plugs, with an output of only 5000 annually. For the year ending Oct. 31, 1918, the output of mica plugs was 2,148,726. The British seemed determined to hold the independence gained by the electrical accessories industry during the war, and the Committee on Commercial and Industrial Policy reported the proposal of the British Ignition Apparatus Association that imports of magnetos from present enemy countries be absolutely prohibited for five years and after that period a minimum duty of 33 1/3 per cent be levied. Imports from other countries, in the meantime, under the proposal, would pay a duty of 33 1/3 per cent and thereafter 20 per cent.

Almost all of the imports of electrical goods by Great Britain are from European countries and the United States, shipments received from the United States having increased during the war. The exports of British electrical manufacturers are widely distributed. In 1917, however, France and Russia together received more than a third of the entire exports of such commodities.

Foreign Trade Opportunities

A firm in Spain (No. 31297) desires to secure the representation of a manufacturer of telephone and telegraph apparatus and supplies. It guarantees deposit on consignment of models manufactured in the United States. Quotations should be given c. i. f. Spanish ports, if possible, or f.o.b. New York. Correspondence should be in Spanish.

A. Serten has associated himself with the Holland Engineering Company, Amsterdam, Holland, and is in charge of the American department, with special attention to the sale of American electrical and mechanical specialties in Holland. This company desires an agency for electrical and mechanical specialties. Catalogs with prices and discounts are requested.

Several of the more important villages of the Cyclades Islands intend to introduce electric lighting in the near future. Necessary material will for the most part be imported. Full information from municipal authorities at Syra, Greece.

The Eastern Electric & Trading Company, V. G. Motwane, manager, Hornby Road, Fort, P. O. Box 459, Bombay, India, founded in 1909, and at present capitalized at $250,000, with branches in several Indian cities, announces that it has dealt mostly in American products, especially telephones, heating and cooking appliances, primary and storage batteries, lighting and power plants and novelties and wishes further manufacturers' representation.

The Allied Foreign Trade Corporation, 44 Whitehall Street, New York City, announces that it is in communication with a man in Brussels, Belgium, who is interested in buying electrical equipment such as: telephone apparatus, watchmen's clocks, time switches, rheostats, motors, transformers, generators, high-tension and low-tension apparatus, lamps, lighting fixtures, electric heating apparatus, insulated tubes with metallic lining, electric fans and pumps and electric power equipment for driving paper mill, weaving and printing machinery. The corporation requests from manufacturers prices and delivery and would like also to receive two catalogs in English, and if possible in French, on the above equipment.

Trade Publications

PANELS.—Bulletin R-4 on standard unit stock panels has been issued by the Benjamin Electric Manufacturing Company, 247 West Seventeenth Street, New York City.

LIGHTNING ARRESTER.—Bulletin No. 2C just issued by the Electro Service Company, Marietta, Ga., describes in detail the operation of the new Bennett surge arrester. Illustrations of installations that have been made on large systems are shown.

CONDUIT FITTINGS.—The Appleton Electric Company, Chicago, has issued supplementary bulletin No. 8-A, in which are listed the new conduit fittings which have been brought out by the company.

PANELS AND CABINETS.—Meter-control panels and switchboards are described in a recent bulletin by the Frank Adam Electric Company, St. Louis, Mo.

REFLECTORS.—Bulletin No. 75, distributed by the Central Electric Company, Chicago, describes the "Maxolite" R.L.M. standard-dome diffuser.

PUMPS.—Copies of a paper on centrifugal pumps read at the sales convention of the Midwest Engine Company, Indianapolis, Ind., by V. Schleyer, are being distributed by the company.

SAFETY SWITCHES.—Bulletin No. 9 of the Trumbull-Vanderpoel Electric Manufacturing Company, Bantam, Conn., describes a line of safety switches.

DIESEL ENGINE.—Copies of a paper on the Diesel Engine delivered at the sales convention of the Midwest Engine Company, Indianapolis, Ind., by N. McCarty, are being distributed by the company.

WAIT TURBINES.—Copies of a paper on Wait Turbines read at the sales convention of the Midwest Engine Company, Indianapolis, Ind., by H. H. Wait are being distributed by the company.

VALVES.—A 156-page catalog describing Nelson valves and containing a price list is now being distributed by the Nelson Valve Company, Chestnut Hill, Philadelphia, Pa.

THEATER LIGHTING.—"Better Lighting Effects in the Theater" is the title of a new booklet descriptive of the theater-lighting control manufactured by the Major Equipment Company, Chicago.

SAFETY SWITCHES.—Bulletin No. 3 of The Trumbull Electric Manufacturing Company, Plainsville, Conn., lists and describes its line of safety switches.

New Incorporations

THE BIFLECTOR COMPANY of New York, N. Y., has been incorporated by D. F. Kenney, W. F. Campbell and A. L. O'Shea, 38 Park Row, New York City, to manufacture lighting and heating appliances. The company has 1125 shares of capital stock of no par value.

THE BATESBURG (S. C.) RURAL LIGHT & POWER COMPANY has been incorporated by D. E. Etheredge, J. F. Wise and W. D. Holstein. The company is capitalized at $5,000.

THE ROCK SPRINGS (TEX.) LIGHT COMPANY has been incorporated with a capital stock of $8,000 by V. A. Brown, L. R. Smart and E. N. Lovelady.

THE FORDSVILLE (KY.) LIGHT & POWER COMPANY has been incorporated with a capital stock of $4,000 by J. B. Westerfield, Fount Crowe and J. T. Smith.

THE SOUTHWESTERN LIGHT & POWER COMPANY of Tulsa, Okla., has been chartered with a capital stock of $100,000 by Jules Constantin, A. W. Mcbride and E. M. Gallaher of Tulsa.

THE TUSKEGEE (ALA.) LIGHT & POWER COMPANY has been incorporated by D. E. Laslie and others. The company is capitalized at $30,000 and proposes to operate an electric light and power plant and ice factory.

THE CAROLINA ELECTRIC COMPANY of Rock Hill, S. C., has been incorporated with a capital stock of $10,000 by A. C. Fennell and R. S. Cannon.

THE LARKIN ELECTRIC COMPANY of Salamanca, N. Y., has been incorporated with a capital stock of $10,000 by G. L. Peters, O. O. F. and M. A. Larkin of Salamanca.

New England States

ANDOVER, MASS.—Considerable new electrical and mechanical equipment will be required, it is understood, in connection with the construction of the proposed new laundry plant of the Community Laundry Company, estimated to cost $50,000, to be located in the Shawnee Village district. Construction work on the new plant has been inaugurated.

BOSTON, MASS.—It is reported that the Edison Electric Illuminating Company will build a big steam generating station on the Fore River.

LYNN, MASS.—Plans have been filed by the General Electric Company for the erection of the proposed new additon to its plant on Western Avenue. Contract for the structure, which will be three-story, about 60 ft. x 100 ft., has been awarded to Charles W. Wright, 23 Central Avenue, and it is proposed to inaugurate construction at once.

MEDFORD, MASS.—The City Council has under consideration the installation of "white way" lighting systems in Medford, West Medford, Haines and Tufts Squares, and the Hillside section. It is also contemplating replacing the present street lights with those of double candlepower.

BRISTOL, CONN.—The New Departure Manufacturing Company is planning to build a new power house to be 50 ft. x 120 ft. x 60 ft. It will be equipped with pumps, blowers, refrigerating equipment and three 600-hp. water tube boilers.

DERBY, CONN.—The Derby Gas Company has completed arrangments for the construction of the proposed new two-story brick, concrete and steel addition to the boiler plant at its electric light station, for increased facilities. The structure, contract for which has been awarded to M. A. Durrschmidt, Derby, will be about 40 ft. x 100 ft.

HARTFORD, CONN.—The Eastern Connecticut Power Company is planning to construct a 33,000-volt line, 60 cycles, from Stonington to Pawcatuck. The proposed method of construction has been approved by the Public Utilities Commission.

HARTFORD, CONN. — The Southern New England Telephone Company has begun work on the addition of its local exchange on Pearl Street. The cost of the building, which is to be a six-story and basement structure, 33 ft. x 90 ft., is estimated at $65,000. The contractor is the Ellison Construction Company of Hartford.

Middle Atlantic States

BROOKLYN, N. Y.—A one-story boiler plant is one of the additions planned by the American Safety Razor Corporation of 303 Jay Street. The new plant, which is for general works service, will be located on Lawrence Street.

BROOKLYN, N. Y.—The Cascade Steam Laundry, Inc., 835 Myrtle Avenue, has had plans prepared for the construction of a new four-story brick addition to its plant, for increased operations, estimated to cost $150,000. Considerable electrical and mechanical equipment will be required in connection with the proposed extension.

HORNELL, N. Y.—The Hornell Electric Company is arranging plans for extensions in its system whereby it will be enabled to furnish electric energy for light and power service practically to the entire Cohocton Valley. This will include the towns of Avoca, Wallace, North Cohocton, Cohocton and Atlanta, and plans are being prepared for the immediate construction of a trunk line to extend from Hornell to Wallace, about 30 miles.

JAMESTOWN, N. Y.—The Jamestown Street Railway, Chautaqua Traction Company, Jamestown, Westfield & Northwestern Railway and Chautauqua Lake Navigation Company are planning to purchase a 3,000-kw., 60-cycle, 3,600-r.p.m., 2,200-volt turbine and a 2,500-hp. boiler.

PORTVILLE, N. Y.—The Public Service Commission has granted the Portville & Cattaraugus County Utilities Company permission to construct its proposed new local electric light and power plant, as well as approval of a franchise granted by the municipal authorities.

ROCHESTER, N. Y.—New equipment will be installed and additions will be made to the present stations of the Rochester Gas & Electric Corporation, in accordance with its plans for increased operations.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

SCHENECTADY, N. Y.—Bids will be received at the office of the Superintendent of Public Works, at the Capitol, Albany, until Feb. 10, for the construction of the Schenectady-Scotia Bridge abutments and approaches, including track work, trolley wires, feeders, lamps and wiring, etc. Plans may be seen at the above office. Edward S. Walsh is Superintendent of Public Works.

SYRACUSE, N. Y.—Following the arrangements of plans by the Syracuse Lighting Company, 339 South Warren Street, for extensive improvements and additions at its plants and system, estimated to cost a total of $750,000, the Public Service Commission has granted permission to the company to issue notes to the amount of $500,000, to be used to defray a portion of the cost of the proposed 1920 expansion program.

ATLANTIC CITY, N. J.—A new double-circuit system of street lighting will be installed on the Absecon Atlantic City Boulevard. The city has had plans prepared for the proposed work.

GLASSBORO, N. J.—The State Board of Education, Trenton, will build a new one-story power plant in connection with the proposed new local three-story State Normal School, estimated to cost approximately $350,000. Plans for the power plant, which will be about 40 ft. x 75 ft., have been prepared.

NEW BRUNSWICK, N. J.—Large quantities of electrical and mechanical equipment will be required, it is understood, in connection with the construction of the proposed new local plant of the Eastern Potash Corporation, 120 Broadway, New York. The company's plans call for the construction of a total of fourteen units to compose the works, which will include the erection of a steam-operated electric power plant, provided with steam turbines, water-tube boilers and auxiliary apparatus; machine shop, about 100 ft. x 200 ft.; new lime kiln, 200 ft. x 280 ft., 42 ft. in height, which kiln, it is said, will be one of the largest of its kind in the world when completed. The equipment installation will include a complete complement of loading and unloading machinery, hoisting and hauling apparatus, etc.

NEWARK, N. J.—The Industrial Factory Sites Corporation has under consideration the construction of a group of five factory buildings. The proposed group will have a central heating system, but each building will have its own lighting system if the present plans are carried out.

NEWARK, N. J.—The New York Telephone Company is arranging for the construction of additions to its various telephone exchange plants in the local district. The work includes extension to its plants at Avan Avenue and Hunterdon Street and at 59 Bloomfield Avenue, estimated to cost $150,000 and $200,000 respectively.

PERTH AMBOY, N. J.—The Raritan Copper Works has plans prepared and inaugurated preliminary work on the construction of two large steel oil-storage tanks to have a capacity of 3,000,000 gal., in connection with its arrangements for the installation of oil-burning equipment in a portion of its plant to replace the present coal operated units. The company has recently completed the construction of a new power plant at its works and will continue the use of coal as fuel in this structure.

SOUTH RIVER, N. J.—The Board of Public Works will build a new one-story brick power plant for municipal service. The structure will be about 55 ft. x 95 ft. and, including equipment installation, is estimated to cost $125,000. Goss, Bryce & Johnson, 55 Liberty Street, New York, are engineers.

CATASAUQUA, PA.—The Lehigh Valley Light & Power Company has had plans prepared for improvements in the municipal street-lighting system, and it is proposed to inaugurate work at once.

EASTON, PA.—The Metropolitan Edison Power Company, of which the Pennsylvania Utilities Company is a subsidiary, has under consideration the construction of a high-tension transmission line to Easton and from there to Dover, N. J.

HARRISBURG, PA—The lighting units in use at the present time in the street-lighting system are to be replaced with units of increased power in accordance with a new city ordinance.

JOHNSTOWN, PA.—The Cambria Steel Company expects to spend about $15,000,000 in expansion work during 1920. Of this amount $2,000,000 will be spent in building two new central power plants. Other improvements include the installation of 4,000 hp. in boilers and superheaters at the Cambria plant, and 8,000 hp. at the Franklin plant.

PHILADELPHIA, PA.—Improvements to the plant of George W. Blabon Company include additions to their central power station which will approximately double its present capacity.

PHILADELPHIA, PA.—Plans have been completed by William F. Read & Sons for an addition to their plant at Jackson and West Twelfth Streets. The addition which is for a boiler plant is to be a one-story building, 23 ft. x 61 ft., and will cost about $7,500.

GEORGETOWN, DEL.—Following the purchase of the plant of John B. Wagamon by L. L. Layton & Sons, plans are being prepared for extensive remodeling and alteration work in the structure for conversion into a cold-storage plant. It is understood that considerable electrical and refrigerating machinery will be utilized.

BALTIMORE, MD.—The Eastern Rolling Mills Company, whose electric generating plant was recently destroyed at a loss reported to be from $35,000 to $50,000, is planning to rebuild the plant.

COLLEGE PARK, MD.—A new central heating plant and conduit system will be installed at the Maryland College of Agriculture. Plans for the work have been prepared by the Board of Managers. It is estimated to cost about $250,000.

CURTIS BAY, MD.—The Sterno Corporation recently incorporated with a capital of $500,000 by interests associated with the United States Industrial Chemical Company, the United States Industrial Alcohol Company and the Curtis Bay Copper & Iron Company, all of Curtis Bay, is having plans prepared for the construction of a new local plant for the manufacture of alcohol-burning devices for automobile service, etc., electric heating and cooking appliances, etc., estimated to cost in excess of $400,000. Considerable electrical and mechanical equipment will be required for the new works. Carl Haner, Jr., connected with the United States Industrial Alcohol Company, is active in the new concern.

WHEELING, W. VA.—It is reported that plans for the purchase of the electric light and gas plant of East Wheeling are under consideration by the Hazel-Atlas Glass Company.

North Central States

DAYTON, OHIO—The Delco-Light Corporation has under consideration plans for the construction of a new power house and other buildings in connection with a central power station. These buildings are part of a building program which, when completed, will greatly increase the size of the Delco plant.

SANDUSKY, OHIO.—The Ajax Rubber Company, 25 West Mount Royal Avenue Baltimore, Md., has acquired a site of about 90 acres in Sandusky for its proposed new plant, to cost about $1,000,000. Arrangements are also being made for a housing project, providing about 400 homes for its employees.

WARREN, OHIO.—Arrangements are being made by the Sunlight Electric Company for the erection of an addition to its plant, 40 ft. x 150 ft.

GEORGETOWN, KY.—Bonds to the amount of $100,000 have been authorized for improvements to the city electric light and power plant and waterworks.

THORNTON, KY.—Contemplated improvements in the local mining properties of the Elkhorn Collieries Company include the installation of considerable electrical equipment.

WHITESBURG, KY.—H. V. Daniel and others propose increasing the capacity of the light and power plant and construction of a new building this year. The improvements will cost $20,000.

DECATUR, IND.—The City Council has selected a site for the new city power plant which will cost approximately $150,000.

DECATUR, IND.—The Indiana Public Service Company has approved the issue of $75,000 electric light and power plant bonds.

EVANSVILLE, IND.—The Evansville Paper Box Manufacturing Company will build a two-story brick and steel plant, containing 300,000 sq.ft.

FORT WAYNE, IND.—The Economy glove factory plant has been destroyed by fire.

GREENCASTLE, IND.—The Putnam Electric Company contemplates the installation of a series street-lighting system, 6.6-amp., alternating current, for Cloverdale. C. W. Otis is manager.

HOBART, IND.—Improvements are contemplated to the municipal electric light plant, including the installation of a new boiler and generator and extensions to local lines. The cost is estimated at about $10,000. R. E. Wheaton is manager.

HUNTINGBURG, IND.—The installation of an additional generating unit in the municipal electric light plant and the erection of a transmission line is under consideration by the City Council. Leo F. Grewe is superintendent.

INDIANAPOLIS, IND. — The Spacke Machine & Tool Company plans new factory building.

LINTON, IND.—The City Council has under consideration plans for moving the city lighting plant and making many needed improvements. Much of the machinery is badly worn and will have to be replaced.

PIERCETON, MD.—The Farmers' Mutual Electric Light & Power Association has been organized to build and equip lines to furnish farmers in the vicinity with light and power. The new company will cover Pierceton, Sidney and Colmer, Ind. T. E. Stone is the electrical engineer.

CHICAGO, ILL.—The L. K. Comstock Company has secured a contract for building a power plant to include sixty 500-hp. boilers, one 300-kw., one 750-kw. and one 1,500-kw., 220-volt generating unit for Sears, Roebuck & Company, Philadelphia. Martin C. Schwab, 30 North Michigan Avenue, is consulting engineer.

DANVILLE, ILL.—The city engineer, Mr. Edwards, is in charge of the new lighting system which is planned for the business district of the city. His estimate calls for a boulevard lighting system with a total of 200 lamps having 12,000 cp. lighting capacity.

HIGHWOOD, ILL.—The Chicago, North Shore & Milwaukee Railroad proposes to purchase during 1920 two 1,000-kw. rotary converters and automatic substation equipment.

PEORIA, ILL.—Bock & Kuhl plan the erection of a twelve-story bulding.

XENIA, ILL.—The Xenia Electric Light Company contemplates the installation of a 25-hp. oil engine and a 20-kva. generator. N. T. Pierce is manager.

FAIRWATER, WIS.—The Fairwater Electric Company contemplates the erection of electric transmission lines into the farming districts. J. W. Laper is secretary and manager.

LAKE MILLS, WIS.—The municipal electric light and water department is contemplating the erection of transmission lines into the farming districts. B. C. Engsberg is superintendent.

MILWAUKEE, WIS.—The bureau of illumination of the municipal street lighting system contemplates the installation of 750,000 ft. of underground cable. William W. Rumsey is general superintendent.

SAUK CITY, WIS.—The Sauk City Power Company is contemplating the construction of a transformer station and power line in Dunn Township. The general manager of the company is in charge of the work.

WAUSAU, WIS.—In order to increase its generating capacity to practically double what it is at the present time, the Wisconsin Valley Electric Company has under consideration plans for the construction of a dam at the foot of Bulls Falls in the Wisconsin River. The project will be undertaken in the spring and will eliminate the falls.

MINNEAPOLIS, MINN.——The City Council has voted bonds amounting to $35,000 for the purpose of building a new power, heating and lighting plant at the workhouse.

DAVENPORT, IOWA.—The Associated Masonic bodies plan the erection of a million-dollar temple.

ASH GROVE, MO.—The Ash Grove Light & Power Company is planning to rebuild its electric plant, which was burned at a loss of $30,000.

EMINENCE, MO.—Contemplated improvements at the present time include the installation of an electrical copper smelter. The work is being done by J. E. Bennett of Springfield, Mo., at an estimated cost of $250,000.

ST. LOUIS, MO.—The American Bakers' Machinery Company has planned to construct a plant that will have 60,000 sq.ft. of floor space. The architect is E. C. Jansen, Chemical Building.

SCHUYLER, NEB. — Bonds to the amount of $55,000 have been voted for rebuilding the electric light plant.

ROSSVILLE, KAN.—The Rossville Electric Light & Ice Company contemplates the installation of a new 60-kw. generator and also extending its electrical service to Delia and Willard. A. H. Daw is manager.

Southern States

MURFREESBORO, N. C.—The Chowan Railway & Power Company wants prices on electrical equipment in connection with the electrical generating station which it is planning to build for a railway from Orlando, N. C., to Franklin, Va.

WINSTON-SALEM, N. C.—The P. H. Hanes Knitting Company, which recently increased its capital from $2,000,000 to $12,000,000, is planning an addition of reinforced concrete to its plant. The new building is to be a six-story and basement, 210 ft. x 83 ft., and will be put up by the Southern Ferro-Concrete Company. The machinery to be installed includes knitting, dyeing, drying and napping machinery.

GREENVILLE, S. C.—A new plant comprising two buildings and estimated to cost $50,000 is to be erected by the Greenville Iron Works. Machinery is to be purchased for the machine shop, which will cover 7,000 sq.ft. of floor space, and for the foundry, covering 8,500 sq.ft. of floor space. The new plant is to be of sheet-iron and steel construction and will have a daily output of 18 tons. W. Lindsay Wilson is the manager.

SENOIA, GA.—The Senoia electric light plant has been purchased by A. H. Jones, who intends to improve the plant so that the lighting system of Senoia will be proportionate to its size.

CHATTAHOOCHEE, FLA.—The contract has been awarded for the new power plant of the Florida State Hospital Home of Nurses. The plant, which is to be of brick and concrete construction, 60 ft. x 120 ft., will cost about $100,000. The engineer is C. S. Hammatt of Jacksonville.

CHATTANOOGA, TENN.—A structural-steel, fireproof building, 100 ft. x 200 ft., will be erected by the newly incorporated Lookout Boiler & Manufacturing Company. Machinery will be installed for the manufacture of plate and sheet-metal work, tanks, towers and boilers.

BIRMINGHAM, ALA.—The Alabama Power Company reports that there is no foundation in fact for the rumors that it is about to build additional hydro-electric plants.

BELZONI, MISS.—The town is to vote on the issue of $275,000 in bonds, the proceeds to be used in improvements to the light and water plants and for paving the streets.

LITTLE ROCK, ARK.—It is reported that plans are under way for additions and improvements to the plant of the Southwestern Bell Telephone Company. These changes, which are made necessary by increased operations, will cost approximately $200,000.

OZARK, ARK.—The Rainbow Manufacturing Company is planning for an addition to its plant which will be 168 ft. x 80 ft. and will cost about $12,000. Machinery to be installed at an estimated cost of $30,000 will be electrically driven with a daily capacity of 1,200 lb. of wrapping twine, rope, etc. W. M. Hunter is the architect and engineer.

WYNNE, ARK.—Bids will be received for the new city water and light plant by the commissioners, S. W. Ogan, R. T. Simmons and W. W. Shaver. Plans for the project have been drawn up by the engineers in charge.

BOYCE, LA.—Bonds to the amount of $30,000 have been voted for improvements to the town electric light and waterworks plant.

NEW ORLEANS, LA.—The New Orleans Railway & Light Company expects during the coming year to purchase a 15,000-kw. turbine with condenser auxiliaries, a 30,000-gal. fuel-oil storage tank with pumps, piping, etc., and a 1,500-kw., 125-250-volt rotary.

KAPLAN, LA.—The city is contemplating a bond issue amounting to $48,000 to cover the cost of improvements to the municipal electric light and waterworks system. Eugene Eleazar is the Mayor.

KENEDY, TEX.—The Kenedy Light & Power Company is planning to rebuild its power plant, which was recently destroyed by fire.

Pacific and Mountain States

ENUMCLAW, WASH.—The Enumclaw Light & Water Company is negotiating for the sale of the company's plant to the city of Enumclaw for a price fixed at $50,000. The price covers the city water system and electric plant.

MUKILTEO, WASH.—The Mukilteo and Seaview Improvements Clubs are considering plans for improvements to the lighting and power service in the city.

SEATTLE, WASH.—In his report to the Mayor, Superintendent of Lighting J. D. Ross asks for $1,750,000 for completion of Cedar Falls power plant to a capacity of 18,000 kw. He estimates the cost of Cedar Falls plant at $3,500,946.66. The sealing of the new dam has cost to date $381,814.07. Completion of penstock and installation of new generator will add $600,000 to the cost of the plant.

TACOMA, WASH.—The Blue Bird Electric Shop recently received contract for electrical fixtures in the new $300,000 apartment house to be built in Seattle by Mrs. Mae E. Young. The contract was awarded on a competitive design basis.

CALEXICO, CAL.—Plans have been completed by the Holton Power Company for the construction of a local substation of reinforced concrete. The work will be begun at once.

HERMOSA BEACH, CAL.—A new electric street-lighting system is being considered by the local authorities.

LOS ANGELES, CAL.—The Southern California Edison Company has under consideration plans for the construction of a substation at New Port Beach, and a power line to San Juan Capistrano. The estimated cost will be $50,000.

MODESTO, CAL.—Application for permission to divert 20,000 cu.ft. a second of water from the Tuolumne River for power and irrigation purposes has been made to the California State Water Commission by the Modesto irrigation district. The project includes the construction of dams, power houses and distributing system at a cost of $16,000,000.

PASADENA, CAL. — The Warnerlite Company expects to build new factories at Pasadena, Cal., and Davenport, Ia., this year and will be in the market for all kinds of factory equipment, motors and electrical machinery.

SANTA BARBARA, CAL.—The city is contemplating the erection of a power house to take care of the city's electrical needs. Bonds necessary for the proposed project will be voted on in the near future.

KELLOGG, IDAHO.—The Bunker Hill & Sullivan Mining & Concentrating Company is planning to build a new hydro-electric plant to supply power for its mill, mine and smelter. The building will be a three-story brick structure.

LEWISTON, IDAHO.—This place has been included in the plan of the Pacific Power & Light Company for extensive improvements. The company will this year spend more than $2,000,000 in improvements and betterments to its plants in the

Northwest, and several thousand dollars will be expended here.

HOLBROOK, ARIZ.—Bonds will be issued to supply the necessary funds for the installation of a new municipal electric light and power plant. Plans and specifications are being prepared for the work. A. M. Nicholson is the engineer in charge.

BINGHAM, MONT.—The city has voted bonds to the amount of $50,000 for a light and water plant. It is proposed to operate the new plant with an oil engine.

CHEYENNNE, WYO.—In order to take care of increased business, the Cheyenne Light, Fuel and Power Company is installing a 1,000-kw. turbo-generator in its power house. This installation necessitates further an increase in condenser and cooling pond capacity.

Canada

VANCOUVER, B. C.—J. C. Reston, electrical contractor, Nova Scotia Building, has received contract for supplying and installing three complete sets of electric equipment for three steel steamers under construction by the Provincial Government in Vancouver. The equipment includes engine room telegraph sets, electric lighting and call-bell systems.

WINNIPEG, MAN.—A transmission line which when completed will be 60 miles long, with a capacity of 20,000 kw., is under construction from Winnipeg to Portage la Prairie. At present one circuit is being installed with an estimated carrying capacity of 5,000 kw. at 66,000 volts. The plans call for a second circuit as soon as the power demand warrants it and substations at Winnipeg and Porta la Prairie. The cost is estimated as $4,600 per mile.

MONTREAL, QUE.—An automobile tire-fabric plant to cost about $1,000,000 is to be constructed near Montreal by F. L. Jenckes of the Jenckes Spinning Company, Pawtucket, R. I. Several of Mr. Jenckes' associates are interested in the enterprise, which will give employment to approximately 1,000 hands.

Record of Electrical Patents

Notes on United States Patents

(Issued Jan. 27, 1920)

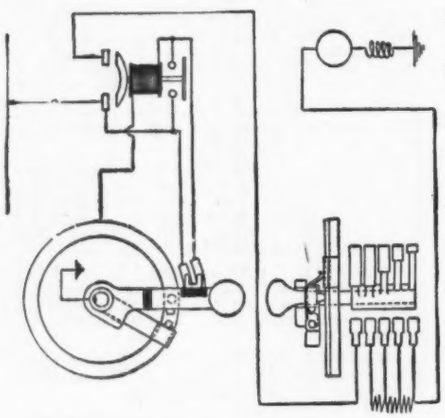
14,797 (reissue). WHEEL BRAKE; Chester B. Mills, East McKeesport, Pa., and John P. Nikonow, New York, N. Y. App. filed July 22, 1918. Motor connected through gearing and levers for rolling and blooming mills.

1,328,804. ATTACHMENT FOR ELECTRIC CONTROLLERS; Arvid R. Anderson, Columbus, Ohio. App. filed Jan. 20, 1917. Protects apparatus during no-voltage periods.

1,328,873. DYNAMO-ELECTRIC STARTING, LIGHTING AND IGNITION MECHANISM FOR AUTOMOBILES; John A. Heany, Jersey City, N. J. App. filed Nov. 3, 1917. Utilizes both motor-dynamo and motor.

1,328,892. STARTER APPLICABLE TO MAGNETOS; Henry Parkin, Philadelphia, Pa. App. filed Jan. 2, 1919. Locks starter.

1,328,925. ROLLED CONDENSER FOR SPARKING APPARATUS; Franz Kratz, Stuttgart, Germany. App. filed Aug. 20, 1919. Frame held together by pressure exerted during winding.



1,328,804—Attachment for Electric Controllers

1,328,933. RADIO RECEIVING APPARATUS; Roy E. Thompson, New York, N. Y. App. filed Aug. 21, 1917. Coupling difficulties eliminated.

1,328,966. ELECTROMAGNETIC BRAKE FOR MOTOR ROAD VEHICLES; George Pollard, London, England. App. filed Oct. 14, 1918. Reduce air gap.

1,328,981. ELECTROLYTIC APPARATUS; Edward O. Benjamin, Newark, N. J. App. filed June 24, 1918. Surface area of plates increased by forming elevations or depressions.

1,328,986. SELECTING SYSTEM; Amos F. Dixon, Newark, N. J. App. filed Aug. 1, 1917. Printing telegraphy.

1,328,993. SWITCH BOX; Don H. Hayden, Cleveland, Ohio. App. filed Dec. 18, 1918. Units fastened together at edges.

1,328,996. TRANSMITTER; William G. Housekeeper, Philadelphia, Pa. App. filed March 25, 1918. Selenium as resistance varying material.

1,329,001. TELEPHONE SYSTEM; Eric R. Lundius, Brooklyn, N. Y. App. filed Jan. 4, 1918. Signals station after termination of conversation.

1,329,004. TELEPHONE-EXCHANGE SYSTEM; Harry W. MacDougall, East Orange, N. J. App. filed June 4, 1917. Automatic ringing systems for link circuits.

1,329,027. COIL FOR DYNAMO-ELECTRIC MACHINES; Simon Sparrow, St. Louis, Mo. App. filed May 29, 1916. Permits length of armature to be reduced.

1,329,029. TELEPHONE APPARATUS; John S. Timmons, New York, N. Y. App. filed April 13, 1918. Talking circuit on aeroplane.

1,329,031. TRANSMITTER SUPPORT; Fred D. Waldron, Brooklyn, N. Y. App. filed Feb. 25, 1918. Held in position.

1,329,043. INDICATING DEVICE FOR VEHICLES; Charles P. Diemer, Sapulpa, Okla. App. filed April 9, 1917. Battery-operated.

1,329,083. ELECTROMECHANICAL CHRONOMETER DRIVING MECHANISM; Cornelis D. J. Jamin, Rotterdam, Netherlands. App. filed Sept. 18, 1917. Rocker operated by electromagnetic and mechanical force.

1,329,125. MANUFACTURE OF ELECTRIC ACCUMULATORS; Henry Leitner, London, and William Exley, Pontefract, England. App. filed April 15, 1919. Lead sulphuric-acid bi-polar type.

1,329,132. ELECTRIC ARC LAMP; Frederick W. Miller, Los Angeles, Cal. App. filed March 8, 1919. Three carbons form single arc.

1,329,135. METHOD OF ELECTRIC WELDING; Thomas E. Murray, Jr., and Joseph B. Murray, Brooklyn, N. Y. App. filed Jan. 15, 1919. Transmission-gear housing welded in one operation.

1,329,136. METHOD OF ELECTRICAL WELDING; Thomas E. Murray, Jr., and Joseph B. Murray, Brooklyn, N. Y. App. filed May 21, 1919. Welds pieces to exact dimensions.

1,329,144. METHOD OF CONNECTING PLATES BY ELECTRICAL RIVETING; Albert B. Rypinski, Brooklyn, N. Y. App. filed Aug. 26, 1919. Metal plate riveted to non-metal plate.

1,329,152. STARTING MECHANISM FOR INTERNAL-COMBUSTION ENGINES; Horace R. Van Vleck, Montclair, N. J. App. filed Dec. 12, 1917. For large high-speed engines.

1,329,167. RHEOSTAT; Robert W. Ebeling, Oakland, Cal. App. filed Sept. 18, 1917. For sign lighting.

1,329,168. MULTIPLE-CIRCUIT-RESISTANCE CONTROL; Robert W. Ebeling, Oakland, Cal. App. filed Sept. 18, 1917. Dims or brightens lights to produce blended colors.

1,329,180. STORAGE-BATTERY SEPARATOR; Walter E. Holland and James M. Skinner, Philadelphia, Pa. App. filed May 17, 1919. Utilizes 40 per cent porosity perforated separators.

1,329,181. STORAGE BATTERY AND METHOD OF PREPARING SAME; Walter E. Holland, Philadelphia, and Lawrence J. Pearson, Wyncote, Pa. App. filed Sept. 5, 1919. Storage for indefinite time without deterioration.

1,329,193. DISTRIBUTING SYSTEM; Paul MacGahan, Pittsburgh, Pa. App. filed Dec. 10, 1914. Section of line disabled without interruption to any substation in ring formation.

1,329,204. ELECTRICAL WATER HEATER; Ralph J. Patterson, Berlin, N. H. App. filed Aug. 20, 1919. Within boiler or in pipe line.

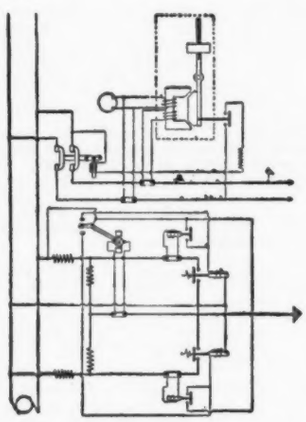
1,329,216. MOTION-PICTURE APPARATUS; Norman T. Whitaker, New York, N. Y. App. filed April 17, 1917. Indicates amount of film projected.

1,329,242. COIL-SUPPORTING DEVICE FOR DYNAMO-ELECTRIC MACHINES; Rudolf E. Hellmund, Swissvale, Pa. App. filed July 11, 1916. Braces coils projecting beyond ends of core members.

1,329,243. SYSTEM OF CONTROL; Rudolf E. Hellmund, Pittsburgh, Pa. App. filed Sept. 9, 1915. Phase-advancing means for regulating operation of polyphase induction motors.

1,329,247. DYNAMO-ELECTRIC MACHINE; Jan A. Kuyser, Sale, England. App. filed Oct. 27, 1915. Ventilates magnetizable core members.

1,329,255. AUTOMATIC PROTECTIVE GEAR FOR ELECTRICAL SYSTEMS; Mostyn Rosebourne, Manchester, and Frederick A. Couse, Urmston, England. App. filed Nov. 3, 1916. When subjected to heavy grounds.



1,329,255—Automatic Protective Gear for Electric Systems

1,329,267. COMMUTATOR CYLINDER; John S. Dean, Wilkinsburg, Pa. App. filed Jan. 5, 1917. Attached fan blades for ventilation.

1,329,276. APPARATUS FOR ADDING TO THE OUTPUT OF A MAIN POWER STATION THE OUTPUT OF ONE OR MORE DISTANT SOURCES; Severn D. Sprong, Brooklyn, N. Y. Automatically interconnecting hydro-electric generating stations.

1,329,277. COMMUTATOR AND PROCESS OF PRODUCING THE SAME; Charles A. Van Dusen, Toledo, Ohio. App. filed Feb. 12, 1919. Utilizes one-piece holder and bakelite insulation.

1,329,283. THERMIONIC AMPLIFIER; Harold De F. Arnold, Maplewood, N. J. App. filed July 30, 1918. Audion type.

1,329,287. AUTOMATIC PARTY-LINE TELEPHONE SYSTEM; Wilson L. Campbell, Chicago, Ill. App. filed July 31, 1906. Party-line subscriber calls automatically.

1,329,315. ELECTROLYTIC APPARATUS; Victor M. Weaver, Harrisburg, Pa. App. filed Aug. 22, 1914. Sealed construction provided.

1,329,330. ELECTRIC FITTING; George B. Thomas, Bridgeport, Conn. App. filed April 30, 1919. Lamp located with relation to focal center of reflector.

1,329,233. ARC-WELDING SYSTEM; Otto H. Eschholz, Wilkinsburg, Pa. App. filed May 7, 1919. Railway voltage used with safety in producing short arc.